PART V.

SUPPLEMENT

TO THE

DESCRIPTION

OF A

PNEUMATIC APPARATUS,

FOR PREPARING

FACTITIOUS AIRS;

CONTAINING A

Defcription of a Simplified Apparatus,

AND OF A

PORTABLE APPARATUS.

By JAMES WATT, Engineer,

DESCRIPTION

OF A

Simplified Pneumatic Apparatus.

AUGUST, 1796.

THE Pneumatic Apparatus, described in Dr. Beddoes's Considerations on the Medicinal Use of Factitious Airs (Part II. Ed. 3rd.) and in a separate Description of that apparatus, is found to answer its intention, so as to leave little to desire upon the head of utility or convenience. What is now offered relates merely to a simplification which may effect a reduction of price; at the same time that in the hands of a sensible practitioner, it will not essentially abridge its utility in the preparation of oxygene air, and of the inflammable airs from charcoal and from iron, though it may not be so proper for the preparation of the zincic inflammable air, or the fixed air from chalk.

If it were natural for mankind to think first upon the simplest methods of performing any process or construct-

ing any machine, ſome apology might be neceſſary for not bringing forward this ſimplification ſooner ; but the contrary ſeems to be the caſe ;—at leaſt the method now propoſed did not occur to the writer until very lately, and ſome doubts being entertained, whether or not it might anſwer as well as it does, it was thought proper to refer that matter to the teſt of experiment, which has occaſioned ſome delay.

The ſimplification conſiſts in laying aſide the hydraulic bellows and refrigeratory, and conveying the air directly from the fire-tube, wherein it is generated, to the air-holder. This was always thought a deſirable object ; but it was conſidered, that if the air were conveyed from the fire tube into the airholder by the pipe U, which receives it from the bellows, it would require a very nice regulation of the exit of the water at the lower pipe Z, to prevent the water in the airholder from weighing with its whole column, thereby making a degree of exhauſtion in the fire-tube and conducting-pipe, and drawing in the atmoſpheric air at every ill-cloſed joint ; the advantage of waſhing the airs, and condenſing the ſteam in the refrigeratory, would be loſt, and there would be opportunity of examining the quality of the air from time to time. A very ſimple idea has in great meaſure obviated theſe inconveniencies ; it conſiſts in making the lower pipe (*z*) of the airholder inclined at an angle of 45 degrees, and of ſuch length that the lower edge of its mouth ſhall be a little higher than the upper edge of the inner opening, by which it communicates with the airholder (ſee *z*, plate 4th, fig. 2.). The airholder being filled with water, and the pipes *k*, *t*, and U very well corked, ſo as to be air-tight, it is evident that no water can run out, though the ſloping pipe *z* be opened, becauſe the

water

water cannot iſſue without the entrance of the air, and the latter is prevented from entering at *z*, by the upper edge of the inner opening being lower than the ſurface of the external water in that pipe. It is exactly in the ſame caſe as the water in the common reſervoir glaſs for birds, into which the air only enters in conſequence of the bird exhauſting the water in the little ciſtern.

Now, in order to receive the air from the fire-tube, as it is produced, all that is neceſſary is, inſtead of fixing the conducting-pipe F horizontally, to make it ſomewhat bent, ſo that its lower end may be inclined at an angle of 45 degrees to the horizon, or thereabouts, and to fit to that end the tin tube (*u*), the end of which being introduced into the ſloping pipe *z*, ſo that its opening, which is in its upper ſide, ſhall be fully within the cavity of the airholder; the air as it enters will aſcend to the upper part of the airholder, and will diſplace its own bulk of water, which will iſſue through the pipe *z*, by the ſide of the pipe (*u*), which occupies only a ſmall part of the opening. The ſituation of the reſpective parts of the apparatus, applied in this manner, is ſhewn in plate 4th, fig. 1, more intelligibly than it can be expreſſed in words.

To prepare oxygene air.— The manganeſe being pounded, and put into the fire-tube, the joints being made good, as pointed out in the former part of theſe directions, and the conducting pipe F fixed as has juſt been explained, and ſupported at a proper height, the pipe *z* being well ſtopped with a cork, and the other pipes *k t* and U both open, fill the airholder quite full of water, and cork the upper pipes very ſecurely, anointing the corks with ſome china clay luting, place the airholder upon its ſtool in the ſhallow tub, which is to re-

ceive

ceive the water; bring the pipe *z* close to the small pipe (*u*), and uncork *z*; then move the airholder towards the small pipe, and insert the end of the latter into *z*, as has been directed; raise the end of the small pipe as high as the opening in the airholder within *z* will permit, and support it there by a small wooden wedge put under it in the mouth of *z*, apply your fire, and the air as it is produced will enter the airholder, and the water thus displaced will issue at *z*, and be received in the tub. When the airholder is emptied of water, down to the level of the under edge of the mouth of *z*, air will begin to issue at *z*. The airholder must now be removed, and, if more air is wanted, another airholder put in its place.

To wash the air. —Slack some good quicklime, and, when fallen to dry powder, sift it through a common hair sieve, preserve it in a pot close stopped for use. If the powder feels damp, dry it over the fire. Provide a tin tube, open at both ends, wired at one end and plain at the other end; its dimensions may be three quarters of an inch in diameter, and four inches long. Dip this tube with its cutting end downwards into the pot filled with the slacked lime, and if the lime is deep enough, it will be filled with it, otherwise it must be dipt again in a fresh place until it be filled with lime. Insert the end of this pipe into *z*, and push the lime into the airholder by means of a piece of wood. If the air is tolerably pure, two fulls of this pipe will be sufficient for half a cubic foot, and four for a cubic foot airholder. The lime may also conveniently be put into the airholder, by thoroughly mixing the desired quantity with half a pint, or a pint of water, and pouring it in through a funnel by the pipe U, at the top of the airholder, the

pipe

pipe Z being previously corked. When you have put in the lime, cork *z*, and shake the airholder very briskly in every direction for about three minutes; then removing the stool, place the airholder in the water in the tub, so that the water may cover the opening of *z*; pull out the cork, and the water will enter and supply the place of the fixt air absorbed; repeat the shaking, until, upon opening the pipe *z* under water, none enters. Replace the airholder upon its stool, insert the end of *u* into *z*, and, by the introduction of more oxygene, displace the water which had been admitted, cork the pipe *z*, and set the airholder in a cool place till it deposits the suspended manganese, which it will do in less than twelve hours, before which time has elapsed none of the air should be used.

If you want to examine the quality of the air before you receive any into the airholder, place the end of *u* in a bason containing water, in sufficient quantity to cover the end of the pipe, and to stand an inch or two higher; then having filled a common bottle or vial with water, place your thumb upon its mouth, and invert it with its mouth under the surface of the water in the bason, directly over the opening of the pipe *u*; the air as it issues will ascend into the bottle, and may be examined by the common tests; or, by holding a lighted taper over the opening of the pipe, you may see by the brightness of the flame, whether or not the air produced is much dephlogisticated.

In general, the air from Exeter manganese has little other admixture than fixed air in small quantity, probably mostly produced by the action of the oxygene on the carbone of the iron tube. Sometimes pieces of a

brown toad ſtone, with whitiſh ſpots, are intermixed with manganeſe: theſe pieces will be eaſily diſtinguiſhed in breaking the manganeſe, and ſhould be picked out, as they yield fixed air inſtead of oxygene. When you mean only to try the air by its effects upon flame, that may very conveniently be done, by placing the airholder in ſuch a manner, that the opening of the conducting pipe, inſtead of being fully within the airholder, may lie in the ſloping pipe, though under water (or by pulling out the ſmall peg in the ſide of F.) When your trials prove ſatisfactory, the airholder is to be brought ſo much nearer the furnace, that the opening of the pipe (*u*) may be quite within it.

Caution. In operating upon ſmall quantities of manganeſe, care ſhould be taken to place them in the middle of the fire-tube: near the ends it may not receive the due heat.

Hydro-carbonate. In preparing this air, the fire tube ſhould be red-hot before any water is admitted by the water pipe; and before the airholder is applied, water ſhould be admitted pretty freely to diſlodge any other air which the charcoal may have imbibed. After about five minutes rapid production of air (which ſhould be conveyed up the chimney by a pipe placed over the opening of *u*), the entry of water ſhould be ſomewhat reſtrained, and the airholder ſet in its place, as has been directed for oxygene.

The proceſs goes on with a proper ſpeed when the large airholder, containing a cubic foot (about 24 ale quarts) is produced in twenty minutes, or half an hour, while the fire-tube is fully red-hot. If water is admitted

too

too freely, ſteam will be produced, and would paſs into the airholder and heat the water there. Beſides, a ſuperfluity of water cauſes the production of a greater quantity of fixed air, than takes place when the operation goes on ſlowly. In order to free the hydro-carbonate air perfectly from fixed air, it may be waſhed with lime, as has been directed; but may be uſed as ſoon as the waſhing is completed, the ſuſpended charcoal ſeeming rather advantageous than otherwiſe.

This ſpecies of air is found to be more or leſs powerful in producing ſenſible effects upon the human body, according to circumſtances in its preparation, which are yet unknown. It merits to be verified by experiments, whether the degree of the heat of the charcoal does not affect it; and in the ſame way it ought to be determined, whether the charcoal of different vegetable ſubſtances do not produce airs of ſomewhat different qualities as to their medicinal effects.

Ferric inflammable air, may be prepared as directed for the hydro-carbonate.

It has been obſerved, that this method is not recommended for the preparation of the zincic inflammable air, nor for the fixed air from chalk; in both of theſe a ſuperfluity of water ſeems neceſſary, and there being no refrigeratory to condenſe the ſteam, it would heat the water in the airholder.

In many experiments, the hydraulic bellows and refrigeratory afford a great convenience, the former in readily aſcertaining the quantity of air produced, and the latter, by condenſing the ſteam; and, when quick lime

is mixt in the water, by abſorbing fixt air and other acid vapours. If the mangameſe is of a good quality, and no inflammable matter is mixt with it, the mixture of lime with the water of the refrigeratory, and the uſe of the agitator, will render it ſufficiently pure to be breathed, eſpecially if it is adminiſtered conſiderably diluted ; but, when given with ſmall admixtures of common air, the utmoſt purity is neceſſary. As in preparing oxygene air, the exact quantity of materials neceſſary cannot previouſly be aſcertained ; if more than fills an airholder be produced, it may conveniently be retained in the bellows till wanted. If azotic air ſhould prove uſeful, as it is very probable may be the caſe, its preparation from burning charcoal requires the uſe of the hydraulic bellows. Theſe bellows alſo make a good machine to inhale mixtures of air from, in place of the ſilk bags.

Every perſon wanting an apparatus will ſee from what has been ſaid, the advantages and diſadvantages of this ſimplified apparatus, and be enabled to judge for himſelf. To thoſe who principally wiſh to prepare oxygene and hydro-carbonate airs, there ſeems no doubt that it will ſave money in the firſt coſt, and ſome trouble each time the apparatus is uſed ; but, to thoſe who wiſh to make experiments upon various airs, the hydraulic bellows and refrigeratory ſeem neceſſary.

Lighting the fire. Some gentlemen complain that the fire in the furnace is difficult to kindle, and that ſome time elapſes before it attains the proper heat. This may be remedied by covering the furnace with a conical tunnel of a foot high, having an opening at the vortex of four or five inches diameter ; but if this tunnel be not

removed

removed as ſoon as the fire tube becomes red-hot, which may be neglected, there is a riſk of melting or ſpoiling the fire-tube. The readieſt and ſafeſt way ſeems to be, to light the fire in the furnace, by means of ſome chips and a ſhovel full of live coals, with the proper quantity of coaks; and to let the lining of the furnace become red-hot before the fire tube is put in; which may eaſily be done by taking out ſome of the coaks, and removing the reſt to the ſides of the furnace, ſo as to make a clear paſſage for the fire-tube, which, having one of its end pieces previouſly luted into it, muſt have the joint of the other made good before it has time to become too hot. The coaks which have been taken out, on being replaced, will readily light again, and much time will be ſaved in heating the tube.

AIRHOLDERS. This ſimplified apparatus cannot advantageouſly be uſed with fewer than two airholders of a cubic foot each, or more of ſmaller ſizes; and the large furnace and apparatus ought to have at leaſt three airholders of the large ſize. The large airholders and their contents of water weighing near ſeventy pounds, it will be found convenient to fill them ſtanding in their place upon the ſtool in the tub; or, which may in ſeveral reſpects be more convenient, though more expenſive, to uſe a double number of three-gallon airholders in place of them. Airholders of ſix quarts are convenient for ſending out doſes of air to patients.

MOUTH PIECES. Many patients with difficulty acquire the habit of inhaling air from a bag, and returning the air from their lungs through the noſe. Some make ſuch deep inſpirations and ſtrong exertions, as to fatigue their lungs and the reſpiratory muſcles, whereby ſpaſmodic pains

pains in the breaſt have ariſen, which in ſome caſes have been imputed to the factitious air; but the ſame pains ariſe in ſuch perſons when only the common air of the atmoſphere is inſpired in the ſame manner, and even when no bag is employed: a mouth-piece has therefore been conſtructed with two valves of ſilk, upon the ſame principle as that communicated to Dr. Beddoes by Mr. W. Capper, and publiſhed in the ſecond edition of the Conſiderations. It is, however, very much ſmaller, gives leſs reſiſtance to the air, and is conſtructed ſo as to be applied to the ſmall end of the faucet of the oiled ſilk bags. With this mouth-piece a perſon may breathe perfectly in their natural manner, without ſtraining the muſcles of the breaſt, and without any other ſubjection than the holding a ſmall pipe in their mouth, the end of which is, for the greater eaſe, made in an oval form.

Queries, however, ariſe, whether thoſe deep inſpirations are not of ſervice, by opening the ſmall veſticles of the lungs, and giving them greater exerciſe? Alſo, whether the hydro-carbonate, at leaſt, may not produce good effects, by acting upon the nerves of the noſe during the exſpiration of the air? Without attempting to ſolve theſe doubts, it is certain that the uſe of the mouth-piece does not preclude the taking deep inſpirations; nor, when thought neceſſary, the expiration through the noſe, though it lays the patient under no ſubjection to either of them.

Alembic, or Fire-pot. This veſſel may be uſed for the preparation of oxygene air in this ſimplified apparatus; *but it ought not to be uſed for the preparation of hydro-carbonate air*; for the water coming firſt into

contact

contact with the red-hot part of the water-pipe, before it reaches the charcoal, hydrogene air appears to be produced instead of hydro-carbonate; at least, it frequently happens that the air prepared from charcoal in this vessel, has not the power of causing vertigo, whereby some gentlemen have been disappointed in the effects expected from the air.

DESCRIPTION

DESCRIPTION

OF A

Portable Pneumatic Apparatus.

PERSONS who have not occafion for large quantities of factitious airs, efpecially invalids while upon a journey, will be enabled, by means of this apparatus, to prepare them readily in any fituation where they can command a common parlour or kitchen fire.

Practitioners in medicine may alfo by means of it, make trial of this new branch of their art, at a moderate expence; but it ought not to be fuppofed that it can fupply the quantities of thefe airs that fome cafes require, and ftill lefs, that by means of it a number of patients fhould be fupplied.

As oxygene and inflammable airs ought not to be prepared in the fame fire tube, the apparatus is provided with one for each of thefe fpecies of air. The fire tube for oxygene air, is made fomewhat like a pocket liquor flafk, the flattened form of which permits it to enter between the bars of a common grate. Its dimenfions

enable it to contain about a pound of powdered manganese, which will generally produce half a cubic foot, or three gallons of air, at one operation.

The figure of this fire tube is delineated in pl. 5, fig. 1, A. and its cross section in its widest part at B.

The fire tube for preparing hydro-carbonate air, is delineated at A, pl. 5, fig. 2, and its transverse section at B. It consists of two parallel hollow cylinders united together, each open at one end, and communicating with one another at the bottom or shut end. The water pipe is adapted to the mouth of one of these hollow cylinders, and the conducting pipe, by which the air issues, is adapted to the mouth of the other cylinder; so that the water, when converted into steam by the heat of the tube, must pass through and among the whole matter contained in both of them, before it can make its exit.

This fire tube (C) with its water pipe (F) and conducting pipe (D), together with the airholder, are represented in their proper positions when in use, at fig. 3, pl. 5. It was judged unnecessary to give a representation of the oxygene fire tube when in use, as such representation would differ in nothing from that given, excepting in the absence of the water pipe, which is not needed in preparing oxygene air.

One joint of the conducting pipe D, is made partly of hammered iron, and the others of tin-plate, japanned. In order to avoid too great nicety in adjusting the place of the airholder, a short flexible tube is interposed betwixt two of the four pieces, of which, for convenience of carriage, the pipe is composed.

Either

Either of the fire tubes, when applied to ufe, being previoufly charged with the proper material, is to be introduced between two of the bars of the fire grate; or, if none of the interftices are wide enough, it may be laid above the upper bar, and the coals heaped over it. If the grate is not deep enough to permit the fire tube to enter far enough into it, when placed at right angles to the bars, it may be put in obliquely; from which the farther advantage will be derived, that the airholder, not ftanding directly before the fire, may be more eafily fcreened from its rays.

The lower end of the conducting pipe turns up a little, and is to be inferted in the pipe z of the airholder, in the manner directed for the fimplified apparatus.

It is proper, before any operation is commenced, to adjuft the height of the fupport of the airholder, and its place in the tub or pail, which is to receive the water; otherwife, if the fire tube heats quickly, fome of the air will be loft before thefe matters can be adjufted. In defect of a ftool, bricks or fhort pieces of board may be ufed as a fupport for the airholder; but, where the apparatus is ufed at home, a ftool will be found moft convenient.

To prepare OXYGENE AIR, fill the fire tube (of fig. 1, pl. 5) with manganefe in coarfe powder, up to the narrow part of its neck, lute the end piece E into the fire tube, and introduce the tube into the fire, lute the iron part of the conducting pipeinto the end piece, and, when the heat has hardened the lute, apply the other parts of the conducting pipe, previoufly luted to one another. The airholder being filled with water, and fet upon its ftool in the tub or pail, uncork the pipe z, advance the airholder

Fig. 1.

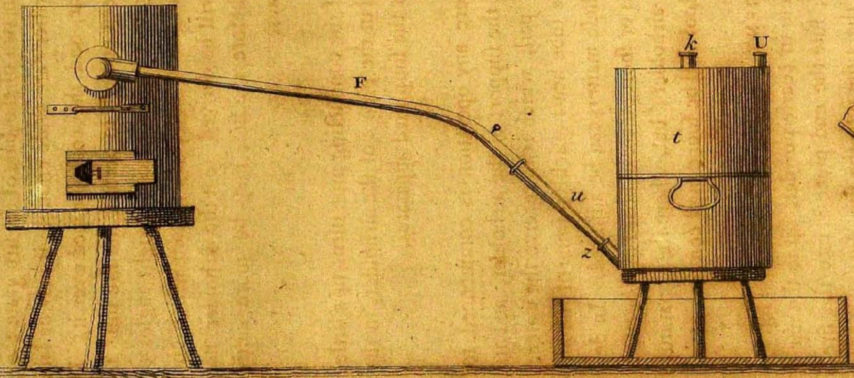
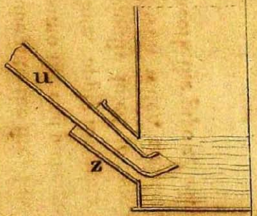


Fig. 2.



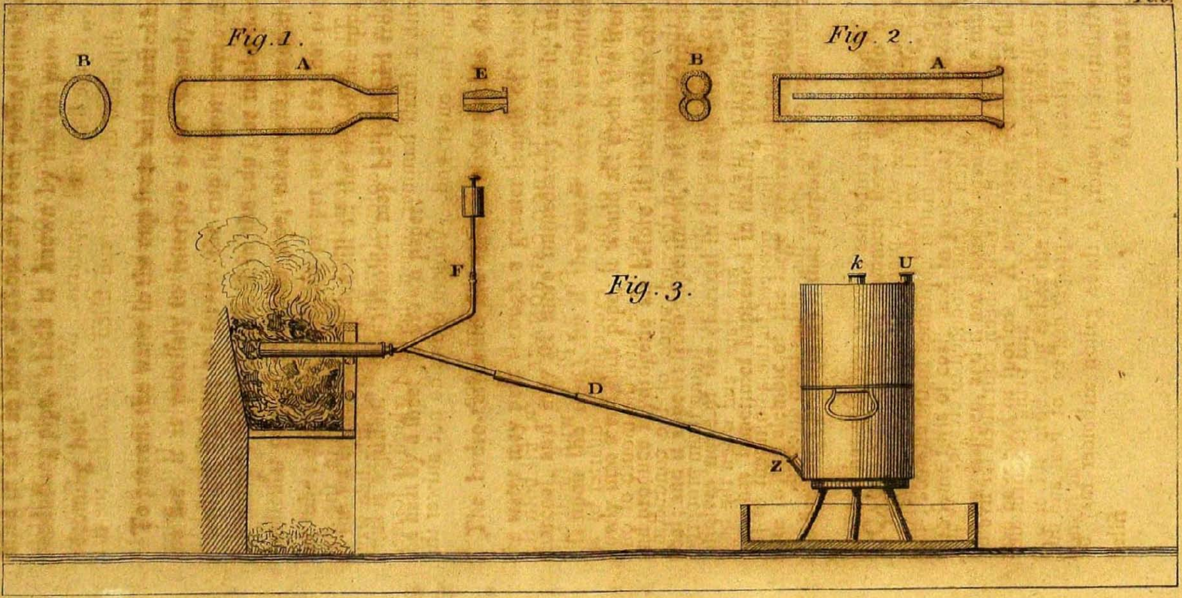


Fig. 1.
B
A
E
B
Fig. 2.
A
F
Fig. 3.
D
Z
k
U

airholder, and insert the end of the pipe D into z. The operation will then go on as has been said in the description of the simplified apparatus. When the oxygene air has displaced the water, and filled the airholder, the fire tube should be immediately withdrawn from the fire, to prevent the needless calcination of that tube. If the joints have been well luted, it may be pulled out by taking hold of the iron part of the conducting pipe, by means of a cloth, to prevent burning the hands.

The end piece sometimes sticks very fast in the fire tube; it may be loosened by striking it gently side ways with a small hammer, upon the bead which is formed round its outer end. Violent blows do not answer the end, and are apt to damage the end piece.

To prepare HYDRO-CARBONATE AIR, fill both the cylinders of the fire tube, Fig. 2, Pl. 5, with small bits of charcoal, none of them exceeding a quarter of an inch cube; insert the water pipe into the mouth of one of the cylinders, and the end piece of the conducting pipe D into the mouth of the other, luting them properly; place the fire tube in the fire grate, and when the heat has hardened the lute, proceed to the adjustment of the remainder of the apparatus, as has been directed.

When the fire tube has become perfectly red hot, admit water by the water-pipe, pretty freely, in order to expel any noxious matter contained in the charcoal, and suffer any air which is thus produced to escape. When this part of the operation has been continued for five or ten minutes, restrain the water, and bring the airholder into its place. With a proper degree of heat and due exhibition of water, a three gallon airholder may be

filled in half an hour, without any ſteam paſſing into the conducting pipe, which is known by the tin parts not becoming hot.

To prevent the water in the cup from being heated by the fire, it is neceſſaty to interpoſe a fire ſhovel, or ſomething ſimilar, to ſcreen the cup from its rays. If the water is ſuffered to boil in the cup; or in the perpendicular part of the water pipe, none will enter the fire tube; therefore it is alſo proper not to fix that part of the water pipe in its place till all the reſt of the apparatus is adjuſted. The airholder may be ſcreened from the heat by a ſheet of brown paper.

The hydro-carbonate fire tube is made double, that the water may paſs through a greater length of heated charcoal, and may act more immediately upon it, and leſs upon the iron; for if the water were tranſmitted ſlowly into a red hot pipe, it would act upon the iron, and produce Hydrogene air before it reached the charcoal; and it appears from experiment, that the hydrogene diſſolves none of the charcoal in its paſſage through it. This has ſometimes happened in making hydro-carbonate in the alembic of the large apparatus, and renders the fire tubes preferable for that purpoſe.

CAUTION. Though common ſtove grates do not generally produce too much heat for this purpoſe, yet with ſome ſorts of coal, and in particular circumſtances that may happen, and if not guarded againſt, the fire tube may be melted or ſpoiled. A moderate red heat is ſufficient for producing either the oxygene or hydro-carbonate air.

AIRHOLDERS

Airholders, proper for this apparatus, are two of three gallons each, or one of that size, and two of a gallon and a half each. The latter will be found convenient for carriage in a post-chaise.

Package. Sets of this apppratus are put up in boxes adapted to them, when so desired, for the convenience of carriage.

POSTSCRIPT.

OBSERVATIONS

UPON

Hydro-carbonate & Oxygene Air.

WHEN a fire tube is ufed for the firft time, any air which is prepared in it has a bad fmell : oxygene air in fuch cafes contains a larger portion than ufual of fixed air, and the hydro-carbonate of fulphurated hydrogene. Thefe have been with juftice imputed to the carbone and fulphur contained in the caft iron of the fire tube.

With a view to correct this inconvenience, a new fire tube, which yielded very offenfive hydro-carbonate, was loofely filled with dry flacked cauftic lime, and fubjected to heat : it gave out, as was forefeen, a confiderable quantity of ferric hydrogene, not remarkably ill fmelled. When it ceafed yielding air, which was after it had been above an hour red hot, it was cooled and filled with charcoal, as ufual for hydro-carbonate ; the air it then yielded fmelled like heated fteel or burning phofphorus ; in fhort, it had the fame fort of fmell as hydrogene air. A query then arofe, whether it had the power of caufing vertigo. A ftout young man inhaled a quart of it, mixed with

with twenty-two quarts of common air, without being in any ways affected by it, which would not have been the case, if it had been prepared as usual. It would then seem, that the vertigo is owing to the admixture of sulphurated hydrogene, which its usual smell indicates this air to contain. If this should prove to be the fact, and any part of its curative powers depends upon its producing vertigo, that effect may be secured or augmented, by mixing the borings or turnings of *cast* iron with the charcoal; or perhaps still better, by the admixture of plumbago, or black lead in powder. If, upon the contrary, the vertigo does not contribute to the cure, the medicine will prove more pleasant to the patient, and it is believed may be uniformly prepared free from the sulphureous smell, by mixing a little *perfectly caustic*, and dry slacked lime, with the charcoal powder.

The effect produced upon the tube by the lime, does not seem to be permanent; for, in a second operation with the same tube, and out of which the charcoal had never been emptied, the air produced had some degree of the sulphureous smell.

It has been mentioned, in the first part of these directions, that a mixture of charcoal powder with slacked caustic lime, produces an inflammable air, without the addition of water, and that the charcoal is consumed in the process: and it has since been found, that a mixture of hammered iron turnings and charcoal produced very good hydrogene air, and that the iron was perfectly calcined by the operation.

This is not quite the proper place to enter upon theory, yet, as it will naturally be asked by some of my readers, how

how these things are to be accounted for, and I wish to throw all the light I can upon the subject, I shall give the explanation of it which appears to me most consonant to the modern theories, though it has perhaps another cause. Slacked lime contains a quantity of water as one of its constituent parts, and which it attracts so strongly, that it will retain the greatest part of it even when red hot, provided no attraction more powerful tends to separate it; but red hot charcoal also attracts water; and it would seem that its attraction for it is stronger than that of lime; the latter is therefore dispossessed, and left in a *dry* state; and the water, united to the charcoal, forms hydro-carbonate or some species of inflammable air, having charcoal for a basis. In the case of the iron, the same thing happens, and hydrogene is formed. Granulated zinc mixed with lime, will probably form zincic inflammable air.

In respect to the medicinal properties, all I know is, that the inflammable air from charcoal and lime contained no fixed air, separable by washing with quick lime and water, and that it did not cause vertigo when inhaled pure.

OXYGENE AIR. This air is also rendered more pure and more free from fixed air, by preparing the fire tube, by heating it full of quick lime, as has been mentioned for the hydro-carbonate; then emptying out the quick lime, and filling it with manganese in coarse powder as usual.

The preparation of the fire tube with lime should be renewed from time to time, whenever an extra produce of

of fixed air ſhows the neceſſity. It might perhaps be ſerviceable to mix quick lime with the pounded manganeſe; but it has been found, that when the lime was not perfectly cauſtic, it gave out its fixed air, and did more hurt than good, ſerving only to prevent the ſulphureous ſmell that oxygene ſometime has.

Oxygene air ſhould never be prepared in a fire tube uſed for hydro-carbonate or hydrogene.

THE SIMPLIFIED AND PORTABLE

PNEUMATIC APPARATUS,

ARE MANUFACTURED BY

BOULTON & WATT,

OF SOHO, NEAR BIRMINGHAM,

AT THE FOLLOWING PRICES.

THE LARGE SIZE SIMPLIFIED APPARATUS.

The furnace, 18 inches diameter, lined with the beſt fire bricks, tongs and poker, two fire tubes, two end pieces, two rings, iron plug, water pipe and cup, iron conducting pipe and its tin end piece, with one large airholder and funnel	£ 6	16	6

AUXILIARY ARTICLES FOR DITTO.

Two large-ſized airholders, one ſpare fire tube, caſt-iron pot for a ſand heat, two oiled ſilk bags and bellows to fill them with common air -	3	6	0

THE SECOND SIZE SIMPLIFIED APPARATUS.

The furnace, 13 inches diameter, and other articles as above, ſuitable - - - - - - - -	£. 4	15	9

AUXILIARY ARTICLES AS ABOVE.

But the two airholders, ſecond ſize - - -	2	15	0

THE PORTABLE APPARATUS.

One oxygene and one hydro-carbonate fire tube, with end pieces, water pipe and cup, conducting pipe, one ſecond-ſized airholder and funnel, and an oiled ſilk bag - - - -	£ 2	12	6

AUXILIARIES.

One ſecond ſize airholder, two ſpare fire tubes and bellows to fill the bag with common air -	1	2	6

*** Packing Boxes and Carriage to be charged extra.

The Pneumatic Apparatus, with Hydraulic Bellows and Refrigeratories, continue to be made as uſual.

See Part II. for the Prices.

Addition to the Supplement.

When this Supplement was printed, it was thought that thoſe who would uſe the Simplified and Portable Apparatus, were already provided with the firſt Part of the Directions; but it appearing that ſuch is not always the caſe, and ſome additional Directions and Precautions having ſince occurred, as uſeful, the following Deſcriptions and Directions, principally applicable to the Simplified Apparatus, are now added.

THE FURNACES are cylindrical, made of ſheet iron, and lined with fire bricks of the beſt kind, ſecured in their places by a ring of iron at the mouth. Two circular holes are made in the oppoſite ſides of the furnace, to permit the fire tubes to be fixed acroſs the centre of the fire, when in uſe. When the alembic or fire pot is uſed in the larger furnace, theſe openings are ſtopt up with plugs of fire brick; and when the fire tubes are uſed, the exceſs of the diameter of the holes over that of

 the

the necks of the fire tubes, is ſhut by caſt iron rings which fit the necks of the tubes.

As ſome may have other uſes for the furnaces, there is a fire door hinged to one of the openings, and a chimney pipe adjuſted to the other, which, with a caſt iron pot fitted to the mouth of the furnace, renders it very convenient for a ſand-heat, in which the mineral acids, and other things can be diſtilled. By ſhutting both openings with their brick plugs, it may alſo be uſed for ſuch operations in an open fire as do not require very great heats.

On the one ſide of the aſh-pit is a regiſter, or ſliding damper, by which the admiſſion of air, and the heat of the fire may be regulated; for even in the proceſſes for producing the factitious airs, though no chimney is uſed to make the furnace draw, if the coaks are good, the heat ſometimes riſes ſo high, as to injure the fire-tubes. On the other hand, ſome coaks are ſtubborn, and burn ſlowly; in which caſe a tunnel, ſuch as is deſcribed in this Supplement, (p. 10) is uſeful; but it will require attention on the part of the operator to avoid the injury juſt mentioned.

The furnace for the larger apparatus, is 14 inches diameter within the lining, and 18 inches over all; the depth to the grate is 11 inches, and the depth of the aſh-pit about 7 inches.

The furnace of the ſmaller apparatus is 9 inches diameter within, and 13 inches over all; the depth to the grate is 9 inches.

The

The Fire Tubes are of two kinds; thofe for oxygene air are now made to fhut at one end, principally to prevent their being accidentally ufed for making inflammable air: the other end is open, but fomewhat contracted, that it may require a fmaller end piece: this contracted part forms a cylindrical neck, which extends through the thicknefs of the brick lining, and to which the caft iron ring is fitted. The remainder of the tube is cylindric.

The fire tubes for the inflammable airs are fimilar to the other: only that they are open at both ends, that the water neceffary for the production of thefe airs may be admitted at one end, while the air iffues at the other. To the open ends of the fire tubes are fitted *end pieces*, ground conically to a joint with the infide of the neck of the tube, beyond which the end pieces are bent at right angles; one of thefe bent parts ftands perpendicular, and its perforation receives the lower end of the *water pipe*; the other, which is wider, lies horizontally, and receives the end of the conducting pipe F, to which it may always remain attached. The oxygene fire tube has only one end piece, which fits the conducting pipe. The other, or clofe end of this fire tube, when in ufe, is fupported upon a piece of caft iron fitted into the hole in the furnace.

The Water Pipe has a cup on its upper end, the mouth of which is croffed by a bridge of iron, through which is fcrewed a wire, conical at the lower end, which ftops the orifice of the pipe, and as it is fcrewed up or down, admits more or lefs water, or entirely ftops the hole. The lower end of the water pipe is ground into

the perpendicular opening of the end piece which belongs to it; and when in uſe this pipe ſhould ſtand perpendicular. The conducting pipe F is ſhewn in the drawing, and has been deſcribed.

The ALEMBIC, or FIRE POT. This veſſel is only uſed in the largeſt apparatus, and is very convenient for making oxygene air, but does not anſwer ſo well for making hydro-carbonate air, as has been mentioned; therefore theſe veſſels are not now fitted with water pipes, unleſs particularly ordered. They have the advantage that they can be uſed in almoſt any furnace that is large enough, or even in a wide kitchen grate: but, as the manganeſe lies more in a maſs in them than in the fire tubes, the operation does not go on ſo ſpeedily as with the latter, and part of the manganeſe towards the centre does not yield all its air.

AIR-HOLDERS. One of theſe veſſels is repreſented in pl. 4, k, U, fig. 1, and the manner of uſing it in the ſimplified apparatus is explained in pages 4 and 5 of this Supplement. They are made of tin-plate, japanned inſide and outſide. They are joined in the middle by a cement of four parts bees' wax, and one part of common roſin. By warming the joining before the fire, they can at any time be taken aſunder and cleaned; and joined again with the ſame cement applied hot. The centre pipe k, reaches very near to the bottom of the veſſel; and the other pipes, U and z, merely enter it. The uſe of z has been explained, page 4; and that of the others ſhall be explained in deſcribing the manner of transferring the air into the ſilk bags. Air-holders are made of three dimenſions; the largeſt contains ſix gallons,

lons, or a cubic foot of air; the middle ſize three gallons, and the ſmalleſt one gallon and a half.

The OILED SILK BAGS are commonly made to contain from 20 to 24 ale quarts of air. They are found to be more convenient to inhale the air from, and to tranſport it from one room to another, than any other exiſting contrivance. They will contain the air for ſome hours, but it is beſt to fill them immediately before the air is uſed. The dimenſions ſtated anſwer very well in common practice, where the doſe of the *factitious* air does not exceed three pints; but, where larger doſes are required, it is adviſable to have larger bags made on purpoſe. Smaller bags, which contain in all only a quart or two, are made for taking out ſmall quantities of air for trials of its quality, or to perform philoſophical experiments.

When the ſilk bags are out of uſe, they ſhould be hung up by a ſtring tied to the neck of the faucet; folding or creaſing them is hurtful. When they meet with any accident, the hole may be mended by paſting over it a patch of oiled ſilk larger than the hole, by means of japanner's gold ſize, or any other tough linſeed varniſh. Both the patch and the circumference of the hole ſhould be anointed with the varniſh, and ſuffered to dry till it is juſt ſticky to the finger; when the patch ſhould be preſſed down on its place, and allowed to dry before the bag is again uſed.

MANGANESE, for the purpoſe of preparing oxygene air, ſhould be free from calcarious earth and noxious minerals, ſuch as lead, arſenic, or copper. A very good kind

kind is found near Exeter, which feems to poffefs thefe properties.

The prefence of calcarious earth may be detected by pouring diluted nitrous acid upon the powdered manganefe; for, if it contain any, there will be a *continued* effervefcence, which otherwife would not take place. The other minerals may be detected generally by the eye, and always by the known chemical effays. The Mendip manganefe, which is always mixed with calcarious earth, alfo frequently contains fmall portions of lead.

The very beft of the Exeter manganefe has a chryftallized fracture, with fomewhat of the appearance of a lead ore, though of a darker colour: another good kind is amorphous in its fracture, and very hard: that which is very tender, and of an earthy or rufty appearance when broken, does not generally contain fo much air, though what it contains is equally pure. All thefe kinds are found in the fame vein, and are unavoidably mixed in the parcels; fometimes alfo there are fmall lumps of a brown ftone, with whitifh fpecks, like toadftone, among it; which will be eafily diftinguifhed in breaking it, and fhould be rejected, as they contain fixed air.

A pound of the hard part of Exeter manganefe yields about 1400 cubic inches of air, nearly pure oxygene, with a very fmall quantity of fixed air.

The fire tubes, or the alembic of the large apparatus hold about fix pounds of pounded manganefe, which yields generally from four to five cubic feet of oxygene air;

air; and thofe of the fmaller apparatus contain about three pounds of manganefe, and yield from two to two and a half cubic feet of air. The fire tube of the portable apparatus holds one pound, and produces about half a cubic foot of air.

CHARCOAL, for making hydro-carbonate air. The beft is that of the fofter woods, avoiding that of oak and fir. It fhould be prepared by heating it to full ignition, either in a covered crucible, or in an open fire, and then extinguifhing it by means of water, or by putting it in a clean earthen veffel clofely covered. When ufed, let it be broken into fmall bits, or coarfe powder, which, with the fine duft arifing in breaking it, are to be put into the fire tube.

IRON TURNINGS or BORINGS. Thofe made from hammered iron produce hydrogene air more pure than thofe of caft iron. The latter contain carbone and fulphur in confiderable quantities; and the air made from them partakes of the nature of hydro-carbonate. Thefe turnings and borings of both kinds are fometimes contaminated with oil or greafe, from which they may be freed by heating them red-hot in a crucible, and quenching them in water.

FIRE-LUTE. To join together the parts of the apparatus which are expofed to confiderable heat, take China or Porcelain clay from Cornwall *(not pipe clay)*, pound it, and mix it to the confiftence of thick paint, with a folution of two ounces of borax, in a pint of hot water; or in default of China clay, flacked quicklime, mixed up in the fame manner, may be ufed. This lute may be kept ready mixed up in a covered pot.

Cold-lute, for the joints of the conducting-pipe, and corks of the air-holders, take equal parts of china clay and wheat flour, by meaſure, and mix them to a proper conſiſtence with cold water. This lute is more tenacious than the other, but it does not keep well; the other may in general be ſubſtituted for it.

Fuel. The moſt manageable for the furnaces is good coaks, or cinders of pit coal, in pieces not leſs than a walnut, nor larger than a gooſe egg. Charcoal of wood alſo anſwers very well, but is more expenſive. Some uſe ſmall pieces of clear-burning pit-coal, free from ſulphur, and not charred or coaked; but ſuch coals cannot be had every where.

DIRECTIONS

FOR

Uſing the Apparatus.

HYDRO-CARBONATE AIR. This proceſs being more complicated than that for making oxygene air, is firſt deſcribed.

Put one of the iron rings which ſerve to fill up the openings in the ſides of the furnace, upon the neck, or ſmall part of that end of the fire tube which you deſtine for the water pipe. Anoint the conical part of the end piece belonging to it with ſome of the fire lute. Inſert the end piece into the opening of the fire tube; preſs it in, twiſting it a little round; then give it a gentle blow with a piece of wood, or a ſmall hammer, to force out the ſuperfluous lute, which ſtroke up round the joint. Raiſe the tube upright upon that end piece, and put into it firſt ſome largiſh bits of charcoal, to avoid choaking the end piece; then, by the help of a wide funnel, put in the ſmall charcoal, till the tube is quite

full up to the other neck; ſtriking the tube on the ſides from time to time, to make the charcoal ſubſide. Stop the open end with the iron plug, or a large cork, and paſs the fire-tube through the holes in the furnace made to receive it; put the other iron ring upon the other neck, ſo as to fill the hole in the furnace on that ſide; take out the plug, and turn the tube round, till the bent part of the end piece for the water pipe ſtands upright. Then, having luted the end of the conducting pipe into the other end piece, anoint the conical part of that end piece with fire lute, and put it into its place in the fire tube, as has been directed for the other; taking care that the conducting pipe lie at the proper inclination to the horizon, as ſhewn in plate 4. When the water pipe ſtands perpendicular, the inclination of the conducting pipe will be in that part governed by the height of the ſupport of the air-holder, which, with the place of that veſſel in the tub, ſhould be regulated before you fill the fire-tube. The lower end of the water pipe ſhould now be anointed with lute, and twiſted into its ſocket in the end piece. The wire ſhould be ſcrewed quite down, a little water put in the cup, and the whole left at reſt until the fire tube is red-hot. The proceſs is then to be managed as has been directed in this Supplement, pages 17 and 18.*

* In the preparation of hydro-carbonate air, no water ſhould be admitted until the fire tube has been for ſome time red-hot. It is alſo found preferable to reduce the charcoal to ſmall bits, or to a coarſe powder; and in the portable apparatus to change the charcoal, putting in freſh at every operation; otherwiſe air will be produced which has not the power of cauſing vertigo.

To extinguiſh the Fire after the operation, ſhut the aſh-pit door and the air-regiſter, and lay an iron plate upon the mouth of the furnace; the fire will then be ſoon extinguiſhed, without damage to the fire tube.

Ferric Hydrogene, and alſo Fixed Air from Chalk, are to be managed exactly in the ſame manner, only that, eſpecially in the latter, the heat muſt be ſomewhat greater than is neceſſary for charcoal, ſay a *full* red heat, and the chalk broken into bits not exceeding one-third of an inch ſquare.

In all theſe proceſſes care muſt be taken that the fire tube be quite filled with the material from which the air is to be produced; otherwiſe the ſteam will paſs over without ſuffering or cauſing any decompoſition.

By mixing about one-ſixth in bulk of caſt iron turnings or borings with the charcoal, you will be more certain of obtaining air which has the power of cauſing vertigo; and by mixing about one fourth in bulk of freſh-ſlacked lime with the charcoal, the air produced will not cauſe vertigo. This air I call *pure* hydro-carbonate, the medicinal powers of which are not yet aſcertained.

Zincic, or Ferric Hydrogene, may be obtained by mixing about two ounces of granulated zinc, or the ſame quantity of iron turnings, with a pound of recently ſlacked lime in the oxygene fire tube, and applying heat without water, as for oxygene.*

Oxygene

* Slacked quick lime may be kept for any length of time quite freſh, or cauſtic, by preſerving it in a well-corked glaſs bottle.

Oxygene Air is prepared according to the directions in page 16; great care ſhould be taken that no bits of coals, charcoal, or other combuſtible matter, be mixed with the manganeſe; otherwiſe ſuch mixture would cauſe the production of a very pungent fixed air, which would be deleterious in caſes where oxygene is proper. Manganeſe may be examined for its contents in lead or copper, by diſſolving it by heat in the muriatic acid diluted; the lead will remain in the form of a whitiſh calx, and the copper will be made ſenſible by the addition of volatile alkali turning the ſolution green. Manganeſe calcined in cloſe veſſels, with charcoal, becomes green; which has led ſome people into the error of ſuppoſing it to contain copper; whereas calces of copper heated red hot become red. Oxygene air ſhould be kept in the air-holder for twelve hours, that it may depoſit the manganeſe which comes over with it, before it is uſed.

To transfer the factitious air from the air-holders into the bags. All the pipes of the air-holder containing the air being corked, the ſhort pipe U is to be uncorked, and the nozzle or faucet of the bag wrapped round with a ſlip of ſoft rag, wetted, and tied on by a ſmall thread, is to be forced *tight* into that pipe. Then, and not before, uncork the centre pipe K, place the funnel in K, and pour in a meaſure of water, equal to the quantity of air wanted for a doſe, holding up the bag with your hand, that the air may meet with no reſiſtance, the deſired quantity will be transferred into the bag. Having replaced the cork in K, ſhut the orifice of the

faucet,

faucet, by putting your thumb upon it, on the outſide of the bag, remove the faucet from the pipe U, and cork that pipe.*

The bag is to be filled with common air, by inſerting the faucet into the nozzle of the common bellows, to be had with the apparatus, and blowing with them till the bag is about half full; when it ſhould be gently clapt on the ſides, in order to mix the common and factitious airs. After which it is to be blown completely full; and the faucet being corked or ſtopped with the finger, it is to be removed to the place where it is to be uſed.

It is a bad practice to put the doſe of factitious air into the bag, and ſend it in that ſtate to the patient at a diſtance, to be there filled with common air: the factitious air either eſcapes, or may be contaminated by the bag, ſo that little effect may be produced. The air-holder appropriated to the patient ſhould ſtand in his apartment, unleſs he reſorts to the practitioner's houſe. Air-holders ſhould be appropriated to each ſpecies of air, and ſhould be properly labelled to prevent miſtakes. They ſhould be kept in a cool place of an equal temperature, and the corks ſhould be good and tight. If ſent to a diſtance, they

* The ſlip of rag ſhould be very neatly wrapt round the faucet, and always wetted at every time of uſing; otherwiſe the air may eſcape by the ſide of it, inſtead of entering the bag; and the bag ſhould always be held up by the hand, and kept from ſuch folds as might impede the entrance of the air. When the bag is clapt on the ſides, the faucet ſhould be ſhut by the finger.

they ſhould be packed in a locked baſket or box, to prevent injuries.

Inhalation of the Air is performed by taking the point of the faucet between the lips, inhaling from the bag through the mouth, and expelling the air from the lungs through the noſtrils; which operation moſt patients readily acquire a habit of performing with eaſe: but thoſe who cannot do it, may uſe the mouth-piece, deſcribed p. 11. It ſhould be recommended to patients not to hurry themſelves, to inhale gently, and to retain the air a little in their lungs before they expel it. It is alſo proper, eſpecially in the uſe of the hydro-carbonate, for the patient to reſt a little at every five or ſix inhalations, to obſerve whether any vertigo takes place: and even in uſing oxygene, an unexperienced patient ſhould reſt to avoid fatiguing the lungs, which of itſelf may cauſe ſome giddineſs.

Doses of the Factitious Airs. Where ſymptoms do not decidedly indicate larger doſes, it is prudent to begin with a pint of oxygene air, in a bagful or half a bagful of common air, that is to ſay, diluted with from 20 to 40 times its bulk of common air, and gradually to increaſe the doſe as ſymptoms direct; obſerving always to dilute with at leaſt 20 times the quantity of common air.

This doſe may be thought too ſmall to produce ſenſible effects; but it will frequently produce very conſiderable ones; and in ſome caſes, where the ſyſtem is very irritable, may prove an over-doſe.

Patient

Patients with a flow firm pulfe, will generally bear large dofes; but thofe with flow feeble pulfes, are generally more readily affected by it. In difeafes occafioned by want of irritability, very large quantities have been given before any effect was produced, even feveral cubic feet per day; but, as in fuch cafes the oxygene was given little diluted or pure, it appears probable that more was given than would have been neceffary, had it been fufficiently diluted; for, if pure oxygene air is inhaled, it will be found, upon its emiffion from the lungs, to be ftill highly dephlogifticated; but, when diluted, it has more time to act, and more of it is probably abforbed.

The hydro-carbonate having powerful effects in caufing vertigo, ought always to be adminiftered cautioufly: where there is much debility, it may be prudent to begin with half a pint of this air, diluted with 10 or 20 pints of common air, to be increafed in the fubfequent dofes, till each dofe fhall caufe vertigo: how far the latter effect fhould be pufhed, muft depend upon the fituation of the patient, and the nature of the difeafe. Patients with a *strong* quick pulfe, can in general bear large dofes of this air, and its immediate effect is rendering the pulfe flower; whereas in patients with quick *weak* pulfe, it generally renders the pulfe quicker and weaker immediately after the inhalation; though its fubfequent effect is to render the pulfe flower and ftronger, if it takes effect upon the difeafe.

It has feldom been found neceffary to give more of this air than from two to three quarts per day, until the patients have been long habituated to the ufe of it; and

in all cafes where the air has ben very lately made, it is proper to give only half the ufual dofe; but, after four or five days keeping, it feems to fuffer little further change. The oxygene air keeps good for months, if the corks are good.

To enable practitioners to judge of the fize of the apparatus which their practice may require, the quantities of oxygene air which each fize can produce at one operation are recapitulated.

The largeft apparatus can produce about four cubic feet at one operation; which will require four of the largeft, or eight fecond fized air-holders to contain it; a great number of air-holders may be neceffary, becaufe fome patients may require the air to be fent out to them, and may not ufe it fo faft as others. In fuch cafes, efpecially where the adminiftration of the air is likely to be continued fome time, it would feem reafonable that fuch patients fhould pay for their own oiled filk bags, if not for the air-holders.

The fecond fize apparatus will produce about two cubic feet of oxygene air in each operation; which will require two largeft, or four fecond fized air-holders to contain it.

The portable apparatus produces three gallons of oxygene air at each operation; which requires one fecond fize, or two fmalleft air-holders to contain it.

As the charcoal does not wafte faft in the operation for hydro-carbonate air, the operation may be continued

with propriety until double the above quantities are produced in the refpective apparatuffes; but it is evident, that in fuch cafes, a proportionate number of air-holders muft be provided for this air, in addition to thofe required for oxygene.

From the above it will appear, that the largeft apparatus is neceffary for hofpitals, practitioners of great practice, or who do not chufe to refort often to a frefh operation: the fecond fize to practitioners of more confined practice; and the portable apparatus to patients who chufe to prepare their own airs, and to gentlemen who wifh to try experiments. To thofe who require confiderable quantities of air, the frequent repetition of the procefs with this portable apparatus will be found troublefome; and it is further to be remarked, that the confumption of fire-tubes is lefs in proportion to the quantities of air produced in the larger than in the fmaller apparatus; and that nothing will tend more to avoid unneceffary repetitions of operations, than the being provided with a fufficient number of air-holders, or other proper recipients for the air.

The fmalleft air-holders, containing fix quarts, are convenient for fending out air to patients at their own houfes.

Oxygene Fire Tubes, when new, ought always to be prepared by filling them with frefh flacked lime, and keeping them an hour red-hot, as has been directed above; but Hydro-carbonate tubes ought not to be fo prepared, otherwife the air obtained from them will not have the power of caufing vertigo.

BOULTON & WATT *beg leave to inform Gentlemen ordering the Pneumatic Apparatus, that the articles called* AUXILIARY *are neceſſary to the Apparatus, and that in general greater numbers of Air-holders and Silk Bags are wanted than what is ſpecified; which, however, can be ſupplied at any time on ſhort notice, as well as the following articles:*

Beſt picked Exeter Manganeſe.

Caſt Iron Borings.

Corniſh China Clay, for Lute.

Borax for ditto.

SETTLEMENT

OF

AN ACCOUNT OF FACTS

BETWEEN

THE EDITOR

AND

A COUPLE OF CRITICS.

SETTLEMENT

OF AN

ACCOUNT OF FACTS.

IN the XXXVIIIth No. of a certain Review, an attempt has been made to discredit the facts, affirmed by Sir Jeremiah Morrison.—" *The whole*" it is remarked, " SEEMS *a flimsy fiction.*"—These scruples, if the professions in the Review are sincere, had in part an honourable intention. They are *said* to have arisen from the flagitious nature of the facts, and from a probable and obliging surmise, that the Editor of the Collection of Cases fell upon the fiction, as likely to promote the subscription to his proposed institution for investigating the medicinal effects of gasses, and to gain him proselytes. Were the question to be determined by internal evidence, it is not likely that the former reason would weigh much with those who are acquainted with the effects of zeal.——For the latter, as the Editor has direct testimony in hand, he will not trouble himself to uncover its nakedness. In producing testimony on the subject of the *enraged Apothecary*, he thinks it proper to re-assert, that

a full

a full authenticated narrative was ſent to him for publication in Part III. It appeared, however, to him, ſufficient to ſtigmatize the tranſaction in general terms.

" *The Apothecary, whom you mention in your work,*
" *actually delivered in his bill, and threatened arreſt, wholly*
" *becauſe my patient, Mr. D——, determined to inhale the*
" *vital air. Before, they were in habits of great intimacy.*
" *If you chooſe to publiſh this in compliment to the British*
" *Critic, you have my permiſſion as well as that of my*
" *patient.*

R. J THORNTON."

On this point the Editor will only add, that, however he may be diſpoſed to compliment the Review in queſtion, he prints the atteſtation with a view to ſatisfy the public, that the imputation was not thrown out at random.

The Editor would have been glad to inſert an atteſtation concerning the incident between the Baronet, his lady and daughter, and the CANDID Doctor. But the practitioner, from whom he received an account of it, and who had his information from the firſt of the above-mentioned four parties, deſired that his name might by no means be brought forward to the public, without a call ſufficiently reſpectable, or ſufficiently urgent.

In the ſame article of criticiſm, ſeveral miſtakes and inaccuracies, though not perhaps of any great moment, might be pointed out. The Reviewer ſpeaks of the

" FOR-

"FORMIDABLE *apparatus with which the airs are ad-* "*ministered.*" Thoſe who have read the deſcription of Mr. Watt's apparatus, ſo as to underſtand it, or have ſeen the thing itſelf, will be amuſed with ſuch a character of a varniſhed ſilk bag, furniſhed with a faucet. For ſuch is the apparatus with which, according to the directions in the pamphlet, and the general practice, the airs have been adminiſtered. Another inaccuracy occurs in the following ſentence: "*The Editor after all consoles* "*himself with the hope, that if this country should ungrate-* "*fully reject his inventions, they will be adopted by the* "*French.*" This is not true. The Editor drops not a ſyllable of complaint or deſpondency, of hope or conſolation. He ſimply expreſſes an aſſurance that the French, who have made ſuch capital diſcoveries in pneumatic chemiſtry, will not fail to cultivate pneumatic medicine.

The paſſages where this Reviewer talks of *regular phyſicians*, p. 590. of *Myersbach and Brodum*, p. 592, the Editor at firſt conſidered as intended to inſinuate calumny, and to form injurious aſſociations. While this impreſſion laſted, he laboured under the very weakneſs which a late lively writer has thus deſcribed from his own feelings:—"*Comme l'humanité est foible! J'ai été assez bête* "*pour être sensible à vos insinuations calomnieuses. Peu* "*s'en est fallu que je ne me sois emporté avec violence con-* "*tre Monsieur le Rapporteur qui se presentoit alors a mes* "*yeux comme un imposteur aussi maligne en intentions,* "*qu' impudent en suppositions.*

"*Vous entendez bien, Citoyen, que tout cela n'étoit que* "*l'effet du premier moment.*"

No

No wonder the Editor ſhould ſo ſoon correct himſelf. He had only to call to mind the firſt motive for diſbelieving the Baronet's facts; which ſhews the writer to be gifted with the innocence of the dove. However, therefore, he may fare as to the cunning, he ſurely cannot harbour the venom, of the ſerpent.

This acknowledgment, it is hoped, will repair the momentary injuſtice of an imputation of malice. If not, the Editor profeſſes himſelf willing to do all further in his power. As nothing more likely to be acceptable occurs, he thus publicly offers his intereſt to bring the Reviewer acquainted with the venerable Baronet. In ſentiments and morals he believes them perfectly ſuited to each other; and how agreeably muſt the anonymous, but *not unknown*, gentleman be ſurpriſed, at finding himſelf by Chriſtmas cloſely leagued in friendſhip with a perſon, whoſe exiſtence he queſtioned at Midſummer!

THE ſecond Critic, againſt whoſe ſtrictures the Editor has to tender a bill of exceptions, is a writer in the *Medical and Chirurgical Review*. An article in No. XIII. affords a curious example of the levity with which ſome people will hazard aſſertions, when they are ſheltered from reſponſibility and ſhame. P. 614 of the Medical Review it is ſaid, concerning the two well-known cancerous patients at Bath, "We underſtand them to have "fallen victims to this dreadful diſeaſe. A ſpeedy recur-"rence of the ſymptoms took place, which the remedy "had

" had no longer a power of mitigating." Anxious for a repetition of the interesting experiments of the late Mr. Magellan and Dr. Ewart, the Editor had sought every opportunity of satisfying the public, that mitigation of the pain of cancer, for an indefinite time, might be expected from the application of carbonic acid gas.

In Part III. of his Considerations, he adduces the authority of Dr. Ingenhousz, who speaks from personal enquiry and inspection. According to this accurate physician, " the ulcer gives no pain when the air is applied," and " it always is better for the remedy." Dr. I.'s letter is dated Oct. 12, 1795. At a still later period, Mr. Sandford found the patient kept " *compleatly easy*," by carbonic acid air. See his letter of Jan. 19, 1796, in the 3d edit. of Parts I. and II. of the present publication, p. 128.

THE Editor solicited permission from these two Correspondents, to publish the result of their observation and enquiry. For false reports concerning these patients had been industriously circulated; and whatever might be the intention of such reports, their tendency was to discourage further trials. The assertions, so confidently advanced in the Medical Review, have induced him to apply for still further information, which he here lays before the public.

BATH, *Aug*. 26, 1795.

DEAR SIR,

IN anſwer to your enquiries reſpecting the two Caſes of Cancer which I formerly publiſhed, I have the pleaſure to inform you that Alford, the ſubject of the firſt caſe is not dead, as has been reported. Sometime after her diſmiſſion from the Infirmary, the breaſt again ulcerated, the carbonic acid air was again applied with relief to the pain, but although perſiſted in for a long time, the ſore did not, as before, aſſume a diſpoſition to heal. It remained however eaſy. * * * * * * * *
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have no doubt contributed much to increaſe her complaint, and rendered it neceſſary that ſhe ſhould be diſcharged.

The other patient died ſeveral months after the publication of my pamphlet. She continued to the laſt to apply the air, which kept the ſore uniformly free from pain, and prevented its ſpreading. She had a complication of other complaints latterly, much more diſtreſſing to her than the cancer, and fully ſufficient to occaſion her death; particularly an inceſſant cough, to which ſhe had been more or leſs ſubject for ſome years, with a profuſe expectoration of very unſeemly matter, and great difficulty

culty of breathing. She was alfo attacked with frequent and fevere nephritic pains, accompanied by fever, which in the courfe of fome days were commonly relieved by a difcharge of calculous concretions by urine, of confiderable fize.

I am, dear Sir,

Your's, &c.

J. EWART.

To Dr. Beddoes.

THE Editor knows not whether the Medical Reviewer will become more circumfpect in future; but his readers will probably perceive what fort of a genius he is for affirmation.

It would be eafy to affign a fatisfactory reafon why the carbonic acid was not conftantly applied to ******. But the Editor does not choofe to drag an unfortunate woman's frailties into day, in compliment to a blundering Reviewer. Let him make enquiry for himfelf; and, if he gets as good information as before, he will acquaint the world that the miller of Billericay himfelf, after he had determined not to be fat, was not fo remarkable for abftemioufnefs from all liquids, as the poor patient, whom he

he, dead-doing critic! has demolished at one stroke of his goose-quill.

These are facts, which can admit no dispute. In the same 13th Number are to be found opinions no less unwarrantable than the assertions are false. The Editor is sorry to observe either the one or the other, in a publication which he had often praised for impartiality, and for which he thinks practitioners, remote from collections of books, obliged to Mr. Boosey.

" The application of the new chemical doctrines to
" the philosophy of medicine, continues to be pursued
" by Dr. Beddoes and his coadjutors, with unabated
" industry. Additional proofs are daily afforded of the
" great influence of factitious airs on the animal system.
" We are sorry, however, to observe so strong a ten-
" dency to speculation in the propagators of this doc-
" trine. There is much reason to fear, that truth will be
" for some time obscured, rather than developed, by the
" enthusiasm of this class of enquirers. That the hasty
" adoption of their doctrines should meet with much
" opposition from the faculty, was naturally to have
" been expected. Men accustomed to think in a cer-
" tain train, imposed by education and early acquired
" habits, are not to be shaken in their opinions by every
" doctrine that wears the face of novelty. Indeed, the
" cause of truth is in all probability much served by this
" very caution, which has been so much ridiculed. New
" doctrines have frequently arisen, which have worn as
" imposing an aspect as those of the aerial projectors;
" which yet time and further enquiry have as frequently

" overturned. By this early oppoſition the authors of " novel opinions are obliged to furniſh themſelves with " new weapons, if any ſuch are to be found, in their " defence. *The acrimonious attacks, therefore, which have* " *been made by this new ſect*, ON ALL WHO FOR WANT " OF CONVICTION, *withhold their assent to their con-* " *clusions*, are not more repugnant to reaſon in them- " ſelves, than unavailable to the ſupport of the cauſe " they have undertaken to ſupport. Had they recol- " lected what took place at the introduction of the cir- " culation, and on many other memorable occaſions of " diſcovery, they would ſee how little reaſon there was " to apprehend that their opinions would be borne down " by authority, without the appeal to impartial enquiry."

This occurs in p. 601, and in p. 613, the writer returns to the charge. As Dr. Beddoes is the only perſon here named, and as the whole paragraph muſt ſeem levelled at him along with others, if not at him excluſively, he thinks that if it had not been intended to involve him, he has a right to charge the Reviewer with culpable inadvertence, in not expreſsly excepting him. If ſuch was the intention, he has ſomethingfurther to ſay.

Dr. B., did he poſſeſs ſufficient abilities, would diſdain to waſte them in maintaining a Warburtonian deſpotiſm over medical literature. He has ſpoken, and may again ſpeak, with aſperity of perſons who endeavour by *immoral means to stifle investigation.* And he ſhould not be ſorry, if he could remove that barbarous antipathy to the advancement of knowledge, under which ſome few Doctors ſtill labour. But what has this to do with attacking *any one*, much more " *all who for want of conviction,* " *withhold*

"*withhold their assent to*" his "*conclusions?*" A diſtinction, ſuch as this, is pretty obvious; though people ſometimes may not obſerve, or may not chooſe to obſerve, it. Shortly after the appearance of Moliere's *Avare*, a Harpagon in real life was heard to complain, that "*no decent* "*careful housekeeper could live in peace, for,*" added he, "*a man must now-a-days turn spendthrift, if he will* "*not be exposed by these profligate playwrights.*"

In the foregoing quotation, the terms, "doctrines," "coadjutor," "ſect," all convey an invidious, and as far as the Editor is concerned, an abſolutely falſe meaning. He originally denominated his ideas on the action of gaſſes *conjectures*, and has always ſince repreſented them as nothing better. He has not heſitated to quit and to diſavow them, whenever he has found them inconſiſtent with facts. Fearful that it might not be in his power to render eſſential ſervice to medical ſcience, he early determined to guard againſt entangling his underſtanding in the cobwebs of his own hypotheſes. In particular caſes he has doubtleſs ſeen gaſſes ſalutary beyond any means known to him. But he has been careful to ſtate that he would not "*give the smallest assurance of success,*" in any one denomination of diſeaſe.——*(See the outline of a plan for a Medical Pneumatic Institution.)*——In the beginning of the laſt century, a noted Doctor on the Continent raiſed a loud outcry about his *gas* and his *blas*; and unbluſhingly boaſted, "*Nova morborum principia,* "*ut et hactenus inaudita theoremata dedi ac demon-* "*stravi.*"—But is his an example for any man of common prudence to imitate now-a-days?

The

The word "*sect*," denotes a number of people, having certain dogmas in common. The Editor agrees in disposition with those, who are ready to exert themselves to improve the art of healing. He is determined to seize any promising means whatever that may conduce to this purpose. Nor has he any the smallest predilection or prejudice towards solids, liquids, aerial or ætherial fluids, as the fixed letter of his publications will attest. With the opinions or works of others, he has nothing to do. He ought not therefore to share their praise or blame. He has never been privy to the design or execution of any publication respecting pneumatic medicine, except such as bear his own name. And he has been much less hurt by all the censure than by some applause which he has incurred.

"*Opinions borne down by authority!*" He has ever been a stranger to so pitiful an apprehension; nor did he require to be schooled by a stupid rehearsal of *sententiae aniles*. Concerning this enquiry, he had often enough expressed his firm persuasion that nothing could arrest its progress. But menaces or artifices, such as he knew on good authority to have been actually employed, might in the mean time prevent this and that individual from obtaining such benefit as the external or internal use of airs can afford. This alone was a sufficient motive for exposing the practices to which recourse has been had.

The various miseries of mankind have from time to time suggested various remedial plans to the Editor. Of these he has suppressed some, and given very slight intimation of others. For they were such as his contemporaries (according to his estimate of their receptivity) would

would not relish, because they had not yet been lashed by the bloody scourge of statesmen into a sufficient knowledge of what is good for them. He fancied, however, that they might be brought to perceive the propriety of investigating the curative powers of elastic fluids. Instead therefore of designs of greater utility perhaps, but more remote from current notions, he has taken pains to recommend this, and he hopes with eventual success.

On other points, the Editor has the misfortune to be dissatisfied with the representation given by this cautious and well-informed censor of medical authors. In p. 603, for instance, Mr. Herdman is said to have refuted the opinion that the excitability of the animal fibre depends on oxygene. Dr. Girtanner, with whom no one individual perhaps in this country has declared his concurrence, may indeed have been refuted. The task was truly easy. But that the oxygene received in respiration, and distributed to the muscles, combines with azote, hydrogene, and carbon, to form water and various saline compounds, is a supposition which no one has yet shewn to be at variance with fact. The two hypotheses differ essentially; and in this very number, the Reviewer notices the Editor's objections to that of Dr. Girtanner, but inaccurately imputes to him the translation of that author's papers.

From the statement in the Review, it might be concluded that the Editor had adopted for his motto:

Oxygen est quodcunque vides, quocunque moveris.

How justly, let the following sentences, from his earliest speculations, bear witness: "Attention is undoubt-
"edly

" edly not lefs due to the other elements of organized " bodies ; and if the importance of oxygene feems to " have been magnified in the foregoing obfervations, it is " only becaufe we have few or no facts which afford a " foundation for reafoning concerning the connection of " an excefs or deficiency of hydrogene or azote, with " the functions of life." *Observations on Calculus*, p. 164.

The rear of this article is brought up by Dr. Ferriar's prediction, that " further trials" with airs, " will be undertaken, with hopes much reduced and " eagernefs greatly allayed." It is not furprifing that a writer who has fo entirely entered into Dr. Ferriar's mode of thinking, and fo exactly copied his ftyle, fhould fo highly extol his writings, and fo emphatically quote his authority. But, in truth, hope and eagernefs—feelings varying in different individuals and at different moments in the fame individual—are little to the purpofe: and when it is defigned to render difappointment more glaring, to talk of high expectations is a ftale rhetorical trick. In difficult refearches, diligence, accuracy, and fertility in refource, are the qualities requifite. The Editor judges that apparent fuccefs, even in a few cafes, is a better reafon for proceeding with alacrity, than failure at firft in a number of trials, for defpondency, efpecially as the modes of trial are fufceptible of fo much variation. Let the impartial and the difcerning decide which way of thinking is the more philofophical.——

And now, courteous Stranger ! thou who haft audited this long account, if thou be fatisfied, it is well—if thou be wifer, thou haft good luck—if thou have been entertained, it is full as much as the writer expected.

APPENDIX.

N°. I.

Remarks on the GASEOUS OXYD of AZOTE or of NITROGENE, and on the effects it produces when generated in the ſtomach, inhaled into the lungs, and applied to the ſkin:—

Being an attempt to aſcertain the true nature of CONTAGION, and to explain thereupon the phenomena of FEVER.

By SAMUEL LATHAM MITCHILL, M.D.F.R.S.E.
Profeſſor of Chemiſtry, Natural Hiſtory and Agriculture in the College of New-York.

THIS is the air mentioned by Prieſtley (ii. Exp. and Obſ. 54, &c.) under the title of *Dephlogiſticated Nitrous Air*. He diſcovered it by expoſing nitrous gas to iron, whereby that aeriform fluid was transformed in about two months to a ſpecies of gas of a very remarkable kind, "which keeps up combuſtion "naturally and freely in a candle immerſed in it, but "is at the ſame time highly noxious to animals, and "deſtroys their life the moment they are put into it;" whereas it commonly happens, that animals can live tolerably well in air ſo vitiated by inflammation, that a candle will no longer burn in it.

He obtained this air too by applying heat to a diſſolution of iron in nitrous acid, after the production of nitrous gas was finiſhed; in a direct proceſs by the diſſolution of zinc and tin in nitrous acid; by expoſing nitrous gas to a mixture of iron filings and ſulphur

 moiſtened

moiſtened with water, and to hepar ſulphuris; and likewiſe by iron and ſolution of copper in the nitrous acid.

He found, that when phlogiſticated air (nitrogene or azotic gas) and dephlogiſticated nitrous air (gaſeous oxyd of nitrogene or azote) were mixed together, it was an eaſy matter to ſeparate them by means of water; for the latter, by reaſon of its readier miſcibility with water, will combine with that fluid in a very pure form, while the former will remain unabſorbed.

Prieſtley's ſpeculations concerning the conſtitution of this air are attended with all the difficulty which beſets the doctrine of phlogiſton; and its true compoſition ſeems not to have been detected until ſince he wrote.

In the ſecond number of the *Recherches Phyſico Chymiques*, publiſhed at Amſterdam, an account is given, which confirms the facts related by Prieſtley. For this gaſeous oxyd was obtained by expoſing nitrous gas for three days over water to the action of wetted iron filings; by the ſubtraction of part of the oxygene of nitrous gas; by the moiſtened ſulphures of potaſh and ſoda; by the muriate of tin; and by ammoniac with a bit of copper in it: it is related alſo, that ſolutions of iron and tin in extremely diluted nitric acid, affords this gaſeous oxyd, and that the nitrate of ammoniac heated after mixture with three times its quantity of ſand, gives toward the end of the operation a large quantity of it.

One of the moſt happy diſcoveries of modern ſcience is that of the *principle of acidity or oxygene* being capacitated to afford products poſſeſſing very different qualities, by combining in greater or leſs proportion with the ſame radical. Thus, for example, azotic or nitrogene gas conſtitutes $\frac{73}{100}$th parts of our atmoſphere. Simple nitrogene, the baſe of this gas, is capable of combining with the principle of acidity as well as the matter of heat (caloric) in four diſtinct proportions. Azote, in its higheſt degree of oxygenation, forms *nitric acid;* in its next, it conſtitutes *nitrous acid;* in a lower, *nitrous gas;* and in the fourth

or

or lowest degree it affords the compound, now more particularly under consideration, *the gaseous oxyd of azote, or nitrogene.* We hence know with the utmost certainty that oxygene, or the base of respirable air, which composes the remaining $\frac{97}{100}$th parts of the atmosphere, is in many processes blended with azote in various quantities.

In the gaseous oxyd, produced by the union of these two atmospheric ingredients, the portion of the acidifying principle combined with its nitrogene base is too small to manifest the smallest degree of acidity; not even so much as to have any effect wrought upon it by exposure to liquid caustic alkali, nor muriated tin; and in its pure state undergoes no shrinking, decomposition, or change, by mixture with the atmospheric fluid, nitrous gas, or vital air.

The properties of this oxyd are so singular and extraordinary, that Priestley affirms, (ii. 55.) at the time of his first publication on the subject, *he should not have hesitated to pronounce them impossible;* to wit, a power at the same time of supporting flame, and of extinguishing life. This surprising quality is however doubtless owing to the difference in the attractive force which its oxygene exerts for hydrogene in the one case, and for carbone in the other; for it is known, that by mixing the gaseous oxyd of nitrogene with carbonated hydrogene gas, the carbone is precipitated from its solution. Hence it appears, that the attraction for charcoal is much weaker than for hydrogene, and that although carbone may be made to burn in the gaseous oxyd, hydrogene is the substance for which it has the closest affinity. And we can now readily conceive how the hydrogene of the candle may in an especial manner contribute, by attracting the principle of acidity from the gaseous oxyd, to keep up the inflammation, wherein some part of the charcoal may likewise, though in a secondary way, be converted to carbonic gas. It may be understood too, wherefore it is not capable of sustaining life. There are two important purposes answered by animal respiration; the one to furnish oxygene to the phosphoric,

phoric, fulphureous and carbonic matter of the blood; the other to carry off its furplufage of charcoal by means of the lungs. Now the gafeous oxyd has lefs action upon phofphorous and fulphur than it has upon charcoal. Hence it is a very natural conclufion, that in ordinary breathing the gafeous oxyd does not only not yield its principle of acidity to the blood in the pulmonic circulation, but at the fame time does not fufficiently attract carbone from the venous portion of it; whence it comes to pafs, that an animal inhaling an air, contributing to neither of thefe falubrious proceffes, muft fpeedily die; its blood being both in a difoxygenated and fuper-carbonated ftate; hydrogene alone being the ingredient in phlogiftic operations which readily attracts its oxygene from the gafeous oxyd.

The proportion of oxygene entering into gafeous oxyd is $\frac{37}{100}$; the other 63 parts being nitrogene; whereas in nitrous gas, the oxygene conftitutes 68 parts of the 100.

On reflecting upon thefe facts, it occurred to me this fubject merited confideration in feveral other points of view: as,

1. Since this remarkable aeriform product is afforded by a variety of artificial proceffes, whether it is not generated likewife by a natural operation in the decay of organized bodies, containing both nitrogene and oxygene?

The hiftory of nitre throws great light upon this query. That fubftance is known to confift of nitrous acid joined to potafh. It is ufually formed during the decay of animal and vegetable bodies, and by a fpontaneous procefs, is produced from their ruins. We are quite fatisfied that azote and oxygene entered into the compofition of thofe bodies when alive, and have gone into new combinations on their difengagement by death. One of thefe recent compounds muft be nitrous acid, conftituting by junction with a faline bafe, the nitrate of potafh. Thus, the theory of the formation of falt-petre neceffarily prefumes the generation of nitrous acid from two of the elements difengaged from organic texture. And as azote, the radical

radical of the acid, is eſpecially abundant in animal bodies, and as Lavoiſier (i. Traite elementaire de Chimie, 155) ſays, *favoriſe merveilleuſement la putrefaction*, wonderfully promotes putrefaction, there is little difficulty in conceiving, both how in ſuch circumſtances it attracts the acidifying principle, and afterwards attaches itſelf to the alkali.

But further than this, the authority of Mr. Becker (Notes to Bergman's Elective Attractions, 327) has been advanced in favour of the production of nitrous acid without the aid of the putrefactive fermentation at all. He found nitrous acid in the urine of cows, which had been eight days expoſed to the ſun. He mixed ſome of the ſoakings of a dunghill with a ley of burnt ſheep's dung and chalk in powder. The mixture began to ferment on the following day, and on the fourth, the internal commotion having ceaſed, he found at the bottom of the phial regular chryſtals of priſmatic nitre. He aſcribes the nitrous acid not to a proceſs going on in the air, but brought about by the *excretions of animals*. On examining the earth of ſtables and cow-houſes, he found its lixivium to yield priſmatic nitre, while that of the dung would afford only ſmall chryſtals, which required an addition of nitre in order to be reduced to a priſmatic form; and he declares he can attract ſalt-petre at pleaſure, in the courſe of three days, from the earth of ſtables and cow-houſes, by uſing for ſaturation well-purified pot-aſhes.

In the production of ſalt-petre, the putrified ſubſtance, if of the animal kind, affords little more than the nitrous acid. This was known to BOERHAAVE, who (i. Elementa Chemie, 44) ſays, the nitrous quality of the earth is derived from the excrements of animals and their putrified carcaſes, particularly ſuch as do not uſe ſea-ſalt, as birds, which, by the addition of the aſhes procured from the burning of plants and of quick-lime, forms ſalt-petre, &c.

This fact of the animal origin of the nitrous acid is confirmed by the teſtimony of MACQUER, (iii. Dictionaire de Chimie, 18) who declares, that in the putrefactive proceſs which affords nitrous acid, animal

mal ſubſtances have a decided preference; ſo that, in order to make chryſtalizable ſalt-petre from ſubſtances purely animal, a quantity of the vegetable alkali muſt be added; while the ſalt-petre produced in the putrefaction of vegetables alone is *naturally* found to be furniſhed with that quantity of fixed alkali which is neceſſary to form good nitre.

To this may be added the authority of FOURCROI, (ii. Lecon Elementaires, &c. 842) who ſpeaks of *acidity* as one of the early ſigns of animal putrefaction; and of the proper putrid exhalation as not to be confounded with carbonic acid, (fixed air) hydrogene gas, (inflammable air) which are at the ſame time let looſe, nor with the phoſphoric emanation which ſometimes glows on the ſurface of corrupting animal ſolids. When to all this it is ſubjoined, that on analizing the ſoil taken from the bottoms of graves where human bodies have putrified, it has been found, though having no communication with the external air, to be highly charged with nitrous acid, the animal origin of this acid is put entirely out of doubt.

We hence ſee the reaſon why the French chemiſts have adviſed the uſe of wood aſhes to neutralize the redundant nitrous acid in their ſalt-petre works, and have even gone ſo far as to recommend foreign potaſh as greatly preferable. On this ſubject, the valuable paper of Mr. MASSEY may be conſulted in the Memoirs of the Mancheſter Society, where it is made to appear, that earths become impregnated with nitrous acid during the putrefaction of animal ſubſtances, but will not afford a cryſtal of nitre until the vegetable alkali is added.*

In

* It is a pity, that notwithſtanding all theſe things, the French Academicians who framed the new Nomenclature, ſuffered themſelves to retain the words *nitrous* acid, *nitrous* gas, &c. which ſeem to me to be very improper, and to be quite as ſubject to objection as the terms *azote* and *nitrogene*, for their radical. The mind becomes unhappily impreſſed with the notion of thoſe products being derived from nitre,

In theſe ſeveral ways we find nitrous acid afforded by the putrefaction of animals themſelves, and by changes in their excretions. Now nitrous acid differing from the gaſeous oxyd barely in the degree of oxygenation, there is no difficulty in comprehending that if there was in any inſtance a ſpontaneous formation of the former, there would *(a fortiori)* be a more eaſy and frequent production of the latter.

And here it happens that the very thing which reaſon ſeeks for, nature affords. That particular gas, deſcribed by Mr. St. John (Preface to Method of Chemical Nomenclature, xi) as produced at certain times during the putrefaction of human bodies in diſſecting rooms, and as being a moſt active and dreadful poiſon, is in all probability the very aeriform product which is the ſubject of this memoir. That exhalation is not only incapable, in its concentrated condition, of ſuſtaining life, but, like the gaſeous oxyd, though it may be rendered leſs injurious by dilution, does not however change its original virulence in the leaſt, by the preſence of the atmoſphe-
rical

whereas the fact is, nitre derives its origin from this *animal acid*. Had I been a member of that committee of the academy, I ſhould have propoſed to derive the name of the radical from the Greek verb *σηπω, putrefacio*; to call it *σηπτον, putridum*; and have made the Nomenclature ſtand thus:

1	2	3	4
Septon; inſtead of azote of nitrogene.	Septous gas; inſtead of azotic gas or nitrogene gas.	Gaſeous oxyd of ſepton; inſtead of gaſeous oxyd of azote or of nitrogene.	Septic gas; inſtead of nitrous gas.

5	6	7
Septous acid; inſtead of nitrous acid.	Septic acid; inſtead of nitric acid.	Septate; Septite, &c. &c.

and then the original of the thing being always ſuggeſted to the mind in the phraſeology, truth would have found a more ready reception, and no ſuch difficulty interpoſed as now beſets us, prepoſſeſſed as we are with the notion, that the nitrous is a *mineral* acid. For it ſhould be remembered, that although it is obtained from nitre, a ſalt claſſed among the mineral ſubſtances, yet it was produced by animal putrefaction before the nitre was formed.

rical fluids; and, like the gaſeous oxyd too, it is not remarkable for any fœtor or particular badneſs of ſmell; both of them differing entirely from the loathſome and nauſeous odour proceeding from dead bodies in a leſs dangerous ſtate of corruption.

The deleterious production, ſo particularly mentioned by Mr. Fourcroi, in his report on the removing the Cimiterie des Innocens at Paris, and now and then fatal to the grave-diggers, appears to be a gas of preciſely the ſame origin and qualities, and as in the former inſtance, is generated in the abdomen.

The gaſeous oxyd of nitrogene in theſe inſtances is always, as far as obſervation goes, of local origin, and ſeldom ſpreads very far in form ſufficiently condenſed to do miſchief. In large cities it is generally moſt abundant, by reaſon of the greater collection, along ſome of their ſtreets, ſewers, wharfs, docks, &c. of thoſe materials which afford it, and on account of the difficulty of ventilation in certain lanes, yards, and alleys, which allows the noxious vapour to ſettle there. In few inſtances that I have heard of, has it extended over a large tract of country; in the greater number of caſes it invades but a limited part of a large city, and that only, when a temperature of the weather, between 75 and 85° of Farenheit's ſcale, favours the formation of the oxyd.

When applied to a living body, freſh and ſtrong on its firſt formation, it produces violent inflammation and ulceration of the fingers or hand which come in contact with the body from which it proceeds; or drawn into the noſtrils, it excites alarming tumefaction, with heat and pain in the fauces and nares; or, if inſpired fully into the lungs, it brings on inſtant death.

2dly. If the firſt queſtion is ſatisfactorily decided in the affirmative, where large maſſes of animal and vegetable matter, in hot ſeaſons and confined places, undergo reſolution into their conſtituent parts, and form new combinations; then is it not preſumeable that gaſeous oxyd may be extricated from ſimilar materials by like cauſes, occaſionally, in the alimentary canal, or *primæ viæ* of human bodies while alive?

For the ſupport of animal life, it is neceſſary that ſupplies of food be, from time to time, received into the ſtomach. The ingredients of diet are of the animal and vegetable kinds, and conſequently contain all the materials, after their introduction into the body, that are proper to ſimilar ſubſtances out of the body. And were it not for the mixture with ſaliva, gaſtric liquor, pancreatic juice and gall, theſe alimentary matters would, from the operation of conſtant heat and moiſture undergo putrefactive alterations in the ſtomach and ſmall inteſtines. By the operation of theſe animal fluids, the nutritious part of the aliment is diſſolved, and prepared for undergoing the proceſs of animalization. For it is to be remarked, that no living thing in the perfectly healthy ſtate exiſts in the animal ſtomach; the deſtruction of life, even in oyſters, fiſhes, frogs, &c. ſwallowed entire, being a preparatory ſtep to their converſion into nutriment; and worms and other animals infeſting the guts, being enabled to live there only by poſſeſſing a conſtitution capable of counteracting the digeſtive proceſs.

Nobody has affirmed, that in the animal inteſtines the fluids are endued with animation, any more than the aliment they contain. Our reaſoning then concerning the whole contents of the firſt paſſages, cannot be governed by the laws which regulate animated ſyſtems, but muſt proceed according to the rules governing the decompoſition of organic bodies in ſuch circumſtances. Chemical inveſtigation here meddles not with living nerves and fibres, whoſe functions are not to be interpreted by its aid, but limits itſelf to the watching into what new forms the inanimate parts of plants and animals are changed after introduction into the belly; a ſubject on which it is certainly competent to decide. It has been conſidered, that in ordinary caſes, the ſolution of food in the gaſtric fluid regularly takes place, and the diſcovery has been acknowledged to be one of the happieſt which phyſiology has to boaſt of. Beyond this, our inquiries are very little ſatisfactory; and the

the inteſtines, though ſo eſſential to health, and ſo frequently the ſeat of diſeaſe, have, in the midſt of much curious reſearch, been ſtrangely overlooked. If, in conſideration of their containing inanimate ſubſtances prone to undergo the putrefactive proceſs, it can be ſhewn, that the cauſes uſually preventative thereof are, during certain ſeaſons, ſuſpended or weakened, then it will be evident that changes may take place within the inteſtines, correſpondent to thoſe which go on without them, and that ſimilar productions will flow from the one which are known to characterize the other.

Sydenham, (continual fever of the year 1661 and ſeq.) ſays, "he would give an emetic in the beginning of that fever, that the ſick might be preſerved "from thoſe dreadful ſymptoms that *ariſe from the* "*filth of thoſe humours that lurk in the ſtomach and* "*neighbouring parts, &c.*" and ſeems to have a good general idea of the noxious quality which the contents of the guts ſometimes poſſeſs. In his account too of the peſtilential fever and plague which raged in London in 1665 and 1666, he enumerates "violent vomitings, "a pain about the region of the heart, as if it were "oppreſſed, and a burning fever" among the earlieſt ſymptoms.

Huxham, (Eſſay on Fevers, chap. viii.) deſcribing the ſymptoms of the fevers which he terms putrid, malignant, and petechial, mentions, that together with "head-ach and giddineſs, *nauſea* and *vomiting* are "much more conſiderable than in the ſlow nervous "fever, *even from the very beginning.*"

In ſhort, in the collected opinions of thoſe phyſicians, whom Mr. Howard conſulted on the plague, as prevailing in the ſouth of Europe and in Aſia, (Account of Lazarettos) dryneſs of the tongue, *vomiting, hiccough, nauſea*, loſs of ſtrength, and fever, are enumerated among the *firſt* ſymptoms.

Indeed, the obſervation of any phyſician of much practice, in complaints of theſe kinds, as well as in the yellow fever, bilious fever, &c. is ſufficient in ſatisfying him, without recurring to written authori-

ties,

ties, that the diseased state of the alimentry canal is not only one of the first group of symptoms that attract his notice, but is of the most troublesome and dangerous nature too.

It has been doubted what could be the cause of so much disturbance in the stomach and bowels. The disorders incident to these are peculiar to animals, and are derived from the necessity we are under, because of our locomotive faculty, of carrying a quantity of manure constantly within us; on which account our organization in this particular differs exceedingly from the vegetable creation, who have their food brought them, but are under no need of taking the crude mass within them. If vegetables then have no analogous ailments, it must be owing to their inhaling their chyle from their external surface, and the inconvenience experienced by animals be referred to their taking into their bellies a good deal of matter beyond what is convertible to nourishment, and carrying the fœculent collection about with them. Our locomotive power is indeed a capital endowment; but the diseases of the alimentary tube, with their endless train of symptoms and consequences, are the immense price we pay for it. Upon this view of the comparative structure of plants and animals, it would seem that we should examine the kinds and qualities of food in the latter, in order to ascertain the causes of those complaints to which they are peculiarly subjected. And here it happens, we have a most striking and instructive fact to guide us. Mr. Verdoni declares, that "the Greek Christians in Smyrna, during the season "in Lent, when they *eat only vegetables*, are very seldom attacked by the plague; while *among those who* "*eat flesh* the contagion makes great havock. Hence "the best means of prevention are to eat moderately, "and *not at all of animal food, &c.*" And I believe a multitude of facts tending toward the same conclusion could easily be collected.

The cause of plague, and consequently of other analogous fevers, would seem to reside then in the animal part of the ingesta; and so, according to the theory,

theory, it ought; for from that ſource ſhould flow the azote, or baſe of the gaſeous oxyd, the cauſe of the moſt alarming and dangerous ſymptoms accompanying this claſs of diſtempers.

It is a fact worthy of particular regard, that the two caſes of contagion cauſed by the gaſeous oxyd, one produced from external cauſes, contaminating the air, and affecting the lungs and reſpiration, and the other ariſing from circumſtances exiſting within the body itſelf, and diſturbing the ſtomach and inteſtines, ſhould have been diſtinguiſhed by Hippocrates. In his book, *De flatibus*, he with great ſagacity, notes the "*aer*" operating without the body, and the "*ſpiritus*" acting within, and both of them cauſing fevers; to the former he aſcribes *epidemics*, where, from a change in the qualities of the air, many perſons are incommoded, as in peſtis; to the latter, he attributes *ſporadics*, where from bad diet flatulencies proceed, creating diſturbance in the whole animal frame.

There are four facts concerning the alimentary maſs which impreſs the mind with the belief of the actual extrication of the gaſeous oxyd in the primæ viæ. Firſt, The production of a gas is manifeſted by tenſion, oppreſſion, and belching, as unequivocal ſigns denoting wind, diſtending the bowels. Secondly, On ſome occaſions there is a vomiting of *black* matter, which conſiſts frequently of extravaſated blood; this tends to determine the gas to be of ſuch a ſort as to afford no oxygene to the blood, which therefore requires no floridity. Thirdly, The exiſtence of *green* ſtools, in certain ſtages of the diſeaſe, point with more certainty to this oxyd as their cauſe, particularly ſince it has been obſerved to tinge both water and glaſs of a remarkable green colour. And fourthly, There is no inſtance related of perſons afflicted primarily with this malady, except fleſh-eaters.

A ſource of poiſonous effluvia thus ſeems to exiſt in our own bodies, ſufficient to diſturb the animal machine exceſſively, and even to effect its deſtruction. There can hardly exiſt a doubt, that the great quantities of butcher's meat, poultry, and fiſh which we

consume, are the materials which chiefly afford the gaseous oxyd, and that in our choicest viands we swallow down the principle of sickness and decay. The flesh of slaughtered animals, prone in hot weather to enter upon an incipient putrefaction, may in some cases not meet with a sufficient corrective in the stomach, and pursuing its propensity there, may go on to rot and rot, and induce by its mischievous productions the most calamitous consequences.

It has been long ago doubted, by considerate and humane persons, whether man was justifiable in preying upon his fellow animals. The authority of revelation, added to the make of his teeth, and the conclusions of reason, have decided in favour of his right. But how far this indulgence, or luxury, (for animal food can scarcely be called a necessary of life,) may be gratified, is left wholly undetermined. Our own experience alone, of the wholesome or pernicious effects resulting from its use, must guide us. Judging by this, there appears a physical certainty, that we devour more of it than does us good; nay, that in the enormous destruction of animal matter, raised in such abundance for our riot and gluttony, some of the most serious of bodily evils are generated, and these particularly in cities, camps and ships, badly regulated. The causes of such distempers are deeply founded in our state of society and way of life, and as long as we gorge ourselves with animal food, and dwell among its putrefactive recrements, the poisonous gaseous oxyd of azote proceeding therefrom, must be expected to disturb both our respiratory and digestive functions, and be followed by scenes of distress and woe.

3dly. Provided, the oxyd should be produced during the disorganization of the food, &c. in the alimentary canal, what changes will it bring about in the chylopoetic viscera, and what symptoms excite in the constitution at large, particularly in those who at the same time inhale more or less of it into the lungs?

No person acquainted with the mode in which the animal body acquires its heat in the lungs, need be informed,

informed that, in a caſe where the gaſeous oxyd has, in a dilute form, been breathed, and from the ſituation and circumſtances of the patient continues every moment to enter the trachea, the ſymptoms will be very different from thoſe of a perſon whoſe reſpiration is free from contagion, but has the noxious gas in his bowels merely. It is therefore to be carefully conſidered, that according to the nature and function of the organ on which the gaſeous oxyd exerciſes its virulence, will there be a variety in the morbid ſymptoms, though produced by the ſame cauſe. If, for inſtance, the ſtomach and the inteſtines are the ſeat of the gaſeous reſidence, inflammatory ſymptoms of thoſe parts, with tenſion of the præcordia, dryneſs and redneſs of the fauces, great heat and high pulſe may be expected to ſupervene;—whereas, if the lungs are pervaded by it, the heat will be moderate, the countenance pale, purple, or yellowiſh, the pulſe ſlow, and the firſt paſſages more quiet; while the moſt violent diſeaſe muſt enſue, when both the lungs and inteſtines are expoſed to its virulence.

1. Let its effects upon the ſtomach and bowels be attended to.

Coſtiveneſs is favourable to the production of this gaſeous oxyd, by retaining the fœces an inordinate length of time, and preventing the ready eſcape of the flatus. Accordingly, it is related, that in the bilious yellow fever of Philadelphia, which prevailed in 1793, (Ruſh's Account, &c. 52.) "the bowels "were generally coſtive, and in ſome patients as "obſtinately ſo as in the dry gripes; and flatulency "was an almoſt univerſal ſymptom in every ſtage of "the diſorder."

From its qualities, as mentioned before, we are at no loſs to explain the painful burning which ſometimes occurred before any vomiting took place, and the gaſtrodynia which at times uſhered in the diſeaſe. Nor, when we conſider the irritated or inflamed condition of the parts, can we be at a loſs to underſtand wherefore it ſeldom appeared without nauſea and vomiting, and why that vomiting was ſometimes ſo long continued, violent and convulſive.

The inflamed ſtate of the ſtomach and duodenum, and other parts of the inteſtinal tube, in all caſes of diſſection after death, and the black, gangrenous and mortified ſpots found thereabout in numerous inſtances, are juſt ſuch as might be expected from the operation of a gas ſo deleterious as the azotic oxyd, which in ſome caſes of high malignancy may be imagined to acquire by union with a larger portion of oxygene than common, an uncommon degree of activity, or *acrimony* as it is called; in its effects, reſembling in every particular that condition induced by the oxyd of arſenic.*

The coffee-coloured, grumous and dark matters ejected from the ſtomach, are probably in a great meaſure derived from the ſanguineous fluid, blackened by contact with the gas, and effuſed from the veſſels ruptured by its eroſion or cauſticity. Some part of them may conſiſt of bile vitiated by the ſame cauſe, and of putrid ichor proceeding from the gangrenous ſpots.

Excoriations of the rectum and external termination of it, correſpond to the inflamed ſtate of the ſuperior portions

* It is remarkable what an analogy there is between this oxyd of azote and metallic oxyds. Azote, as well as the metals, in its pure ſtate has little or no chemical operation upon the body: as ſoon, however, as they become oxydated, they acquire activity; and that this activity is proportioned to the quantity of oxygene they abſorb, is ſufficiently evinced by the preparations of antimony, arſenic and quickſilver. There is another trait of character in which azote reſembles arſenic and ſome other metals, which is, that they are both acidifiable baſes: as by increaſing the quantity of oxygene, you change the oxyd of the metal to an acid, poſſeſſing powers greatly ſuperior to what it poſſeſſed before, ſo, by giving the oxyd of the gas a larger doſe of the acidifying principle, you increaſe its activity to an extreme degree. There is thus a very ſtrong chemical analogy between the oxyd of azote, and white arſenic. Perhaps azote is a metal. Quickſilver is a metal, maintaining *fluidity* under the common circumſtances of terreſtrial heat and atmoſpherical preſſure. May not azote be a metal exiſting in the ſame circumſtances of warmth and weight in a *vaporific* form?

portions of the inteſtinal canal, and are fairly aſcriba-ble to the ſame cauſe; as is alſo the hiccuping.

In a word, the pain in the ſides, and in the regions of the ſtomach, liver, and bowels, with their hotneſs and ſpaſms, and with the conſequent diſtreſs both of body and mind, all indicate the locality of this malady, as well as point to the nature and cauſe of it.

There is one caſe which may be imagined to happen, in which the ſtomach and bowels are diſturbed by the gaſeous oxyd ſwallowed with the ſpittle and the food. Where the oxyd is abundant, it can eaſily be underſtood from its diſpoſition to unite with water, that ſome part of it may attach itſelf to the fluids of the mouth, and be ſwallowed; as alſo forming a connection with the alimentary maſs in the act of chewing, may, together with it, deſcend into the ſtomach; and thus, in either caſe, produce its harmful effects.

2. Its operation upon the lungs ſhall be next inquired into.

If a full inſpiration of the gaſeous oxyd be made, there will be a ſudden extinction of life; and this accordingly accounts for the fact related by Ruſſel, (Hiſtory of Aleppo, p. 232.) and confirmed by other obſervers, of many perſons falling down dead ſuddenly, when ſtruck with the contagion of the plague.

If a quantity of the ſame fluid be mingled in ſuch proportion in the atmoſphere, as by its dilute ſtate to produce neither immediate death, nor catarrhal affections, then the ſlow and undermining effect of it, by conſtant breathing, will be manifeſted, firſt in the ſighing, anxiety, toſſing of the body; afterwards by langour, faintiſhneſs, coma; and afterwards by the ſleep-like and gentle approach of death.

An inhalation of a more condenſed or concentrated oxyd will account for the pulmonic ſymptoms ſometimes occurring, give riſe to pain and convulſions, and lead to an explanation why, after running a certain length, they ſhould ſuddenly end in effuſions of blood or other fluids to ſtop the reſpiration entirely.

I am ſatisfied, from experiments repeatedly made upon myſelf and others, that the heat of the body and beat of the heart and arteries are, to a certain degree, under the government of the will. This depends upon their connection with the reſpiratory organs. If, while all the other voluntary muſcles are at reſt, breathing be quickened by an effort of the will, the action of the heart and arteries will be increaſed, and ſo will the heat of the body; if, on the other hand, a perſon ſitting as quiet as poſſible in a chair, inſpires the ſmalleſt poſſible portion of air that he can, without bringing on anxiety, and continues to do ſo for ſome time, a thermometer placed in the arm-pit will fall ſeveral degrees, and the pulſations of the heart and arteries be exceedingly diminiſhed in frequency and force. I mention theſe experiments to ſhow how intimate the connection between reſpiration and the circulation of the blood is in the moſt healthy ſtate of the body, and how the latter is governed by the former. The heat of the body is nearly, other things being equal, in proportion to the oxygene gas decompounded in the lungs, and ſo alſo is the force of circulation from the ſtimulant quality imparted to the blood. If the air inſpired be mixed with a large quantity of non-reſpirable air, then, though a full inhalation be made, there will be but a ſmall portion of vital air decompounded, and, as in the caſe of voluntary diminution of the breathing, the heat muſt be leſſened, and the contractions of the heart be more ſlow and feeble. It can eaſily be underſtood then, wherefore in ſome caſes there ſhould be weakneſs of pulſe; in others, no uncommon quickneſs or frequency; in others again, ſuch lowneſs that it can be hardly felt. We hence are enabled to underſtand why the pulſe ſometimes intermits, and to account for that remarkable ſlowneſs, which, when conſidered in this point of view, indicates extremeſt danger; while, according to the ordinary way of judging, it has been conſidered as denoting that there was no fever: and the juſtneſs of this interpretation is confirmed by obſerving, on diſſection,

the blood in the heart refembling, in its qualities, the blood of perfons that have been hanged. The coolnefs of the fkin and the coldnefs of the limbs are in this manner very naturally accounted for.

In certain cafes of high malignity, the bodies of patients dead of fever caufed by this gafeous oxyd, have been all over disfigured with purple fpots, and have even fometimes affumed a blackifh hue. Yea, even during life, vibices and blacknefs are known to make their appearance, and when they do, to be attended with coldnefs prevailing in the livid parts a day or two before death. Thefe appearances are entirely explicable upon the idea, that the lungs are filled with a fpecies of air, not capable of oxyganating the blood, carrying away its carbone, and imparting heat to the body. The cafe defcribed by Huxham, in pages 98 and 99, is a very inftructive one, and illuftrates this doctrine in a forcible manner; as does the cafe defcribed by Sandifort. (Obf. Anatom. Pathol. 11.)

From a review and confideration of the hiftory of fuch cafes, it would appear there was a *fcorbutic habit* of body induced, and that the hæmorrhagies, debility, and proftration of ftrength, as well as the darkened colour of the blood, and the want of cohefion in the folids, might be all accounted for upon the fame principle in fever as in fcurvy.

It very foon occurred to me, if my idea was juft, that the gafeous oxyd ought, when in a concentrated form, and approaching the ftate of an acid, to manifeft itfelf by corroding metallic fubftances. On inquiry, I found facts of that kind on record; for Van Swieten relates, "that in the plague of Oczakow, the *filver* hilt of a fword, which all the time "of the plague hung up in a tent, was changed "*quite black*; and the inftruments which the furgeons "made ufe of were turned as *black* and *livid* as if "they had been dipped in *aqua fortis*," (nitrous acid.) (Comment. in Aphor. Boerhaav. §. 1407.)

Upon difcovering this, I became convinced, that if my conjecture was right, a fubftance fo active as the

the gaſeous oxyd ought, when applied to the ſkin of well perſons, to excite diſorder there, and this I found to be true: for Van Helmont (Tumulus Peſtis, p. 853.) ſaw a man, " who, upon touching " ſome papers infected by the plague, felt inſtantly " a pain like the prick of a needle; a peſtilential " carbuncle made its appearance ſoon after on his " fore finger, and he died in two days." A man who ſtirred up with his foot the ſtraw whereon the bed of a perſon ſick with the plague had been laid—" a little while after he felt an acute pain in " the lower part of his leg, juſt above the foot, as if " the part had been ſcalded with boiling water; the " next day the epidemis or ſcarf-ſkin was elevated " into a large bliſter, upon breaking which, a quan- " tity of blackiſh liquor ran out, and, underneath, a " latent peſtilential carbuncle was diſcovered, which " could hardly be cured in a fortnight." (Van Swie- ten, § 1409.)

There was another inference from my principle upon which I laid ſo much ſtreſs, that if it had not turned out according to my prediction, I ſhould have given up the whole matter as viſionary. This was the effect that air of the kind I had in contemplation ſhould have upon brute animals of the domeſtic kind. Thus *Sorbait* of Vienna (quoted by the laſt mentioned author) ſays, that during the plague, " *larks* ſo nu- " merous in Auſtria during the autumn, where " wholly wanting, ſo that not a ſingle one could be " met with; and *tame birds kept in cages all died*." Homer mentions the death of *dogs* and *mules* as the forerunner of the peſtilence in the Grecian camp before Troy. (Iliad i. 69.) The pernicious and deadly effects of the atmoſphere during the plague at Athens, in the ſecond year of the Peloponneſian war, upon birds and beaſts, and particularly on dogs, is mentioned by Thucidydes* (B. ii.) Boccace, in his

* The diſputes concerning Epidamnus and Corcyra had for ſome time agitated the governments of Corinth and Athens. Theſe diſſentions, founded chiefly in a jealouſy of the growing and encroaching power of the people of

his account of the plague at Florence, "ſaw with "his own eyes, *two hogs* that had rolled about with "their ſnouts, and gnawed ſome pieces of bread "which had been thrown from a poor man's houſe "who

Attica, furniſhed ſufficient pretexts for moſt of the ſtates of the great Peloponneſus, to join in a confederate war againſt them. In the 431ſt year before Chriſt, the war began between the Peloponneſians and Athenians, and their confederates on both ſides. That more vigorous preparation might be made for war, Pericles adviſed the Athenians to move from their country reſidences to their chief town Athens. His advice was followed. They ſent away their flocks and labouring cattle into Eubæa and the adjacent iſlands, tore down their houſes, and with their wives, children and furniture ſorrowly moved from the open country, where they had been accuſtomed to live, to their metropolis. Great inconveniences were now experienced by them, eſpecially ſince that, after repairing the waſte committed by the invaſion of Xerxes, the inhabitants had eſtabliſhed themſelves in a moſt comfortable way of living. After moving, they were obliged to adopt a new mode of life: few had houſes ready for their reception: ſome ſheltered themſelves with their friends and relations: the greater part were forced to ſettle in the leſs frequented quarters of the city, in the buildings ſacred to the gods and heroes: and many were even obliged to lodge themſelves within the turrets of the walls, or wherever they could find a vacant corner. In ſhort, there was a greater number of people than the city could contain, and after the *Pelaſgic* was occupied, the *Long-walls* and great part of the *Piræus* were portioned out to them for *little* dwellings. Thus pent up, the Athenians continued accumulating filth and noxious matter among them during the winter and until the enſuing ſummer, when, on the operation of heat, the gaſes were volatalized that brought on the memorable ſickneſs, which has been called the *plague of Athens*. The attempt of *Thucidydes* to trace it back to *Lybia*, *Egypt*, and *Æthiopia*, is wholly unſatisfactory, and juſt as groundleſs as our own endeavours at preſent to prove *yellow fever* always imported from the Weſt-Indies or ſome other foreign place. The cauſes of the plague at Athens, which was, in fact, only a very bad yellow fever, exiſted among themſelves, juſt as they do among the New-Yorkers and Philadelphians now-a-days. A truth ſo plain and ſo important as this is, ought to be candidly received by every citizen of the United States.

"who had died of the plague, inſtantly ſeized with "convulſions, and died within an hour after." In *dogs* and *cats* the ſymptoms of plague have actually been known to appear, ſhewing themſelves in the form of buboes, &c. The *cats* of Philadelphia died in 1793, and it is highly probable their deaths are to be in part aſcribed to the gas they breathed.

Again, if the idea I entertained was well founded, the gaſeous oxyd ought, when very concentrated, to ſhew its capability to ſupport flame. The two following facts, though not related with ſufficient accuracy or diſtinctneſs, are however caſes in point, and as far as they go, illuſtrate and confirm the doctrine in a forcible manner. The firſt is "that a lighted candle "being held near dying perſons, a very *livid* vapour "was ſeen to iſſue from their mouths." The other, the relator ſays, he frequently obſerved in the form of a *blue* ſmoke, as it were, in the rooms where the infected lay. (Van Swieten, § 1407.) Now, when theſe facts are compared with what Prieſtley deſcribes of a candle burning in the gaſeous oxyd with an enlarged flame, by another flame (extending every where to an equal diſtance from that of the candle, and often plainly diſtinguiſhable from it) adhering to it, and in ſome of his experiments burning *blue*, there appears to be conſiderable ſimilarity in the caſes.

Moreover, knowing that under an atmoſpherical preſſure, which ſupports the quickſilver in the barometer at 29.84 inches, and in a temperature of 54.5 of Farenheit's ſcale, a cubic foot of azotic gas weighed one ounce thirty grains and one half; and of oxygenous gas, one ounce one dram and fifty-one grains: it was preſumable that a combination of the two, that is, thirty-ſeven parts of oxygene united with ſixty-three of azote, would form a fluid of nearly the ſame weight with atmoſpherical air, or rather heavier, and the probability of this would increaſe, by conſidering that a cubic foot of nitrous gas, which contains only thirty-one parts more of oxygene than the gaſeous oxyd does, weighs one ounce two drams and thirty-nine grains. An inference from this is, that perſons who reſide in low ſituations, where the gaſeous oxyd is generated, or

or patients who lie near the floors of infected chambers, ought to ſuffer more than others, by reaſon of their breathing an atmoſphere more loaded with non-reſpirable vapour, tending downward on account of its weight. This inference from the principle is alſo conformable to fact, ſince it is known both in New-York and Philadelphia, the lower parts of the city have been moſt ſeverely afflicted, and that phyſicians, friends, nurſes, &c. who walk erect in the chambers of the decumbent ſick, eſcape danger, and breathe a tolerably pure air; while the unhappy patient, lying near the floor, toward which the heavier oxyd ſettles, inhales deadly gas at every inſpiration.

Again, it was clear to me from the little diſpoſition the gaſeous oxyd poſſeſſes to combine with other bodies, and from its conſiderable weight, that it might be tranſported from place to place, in tight boxes or packages of goods, &c. and that on opening theſe, and taking out their contents, the unchanged gas might be inſpired into the lungs, or inſinuate itſelf into the ſtomachs of ſuch perſons as ſhould be expoſed to it. This inference from the principle is alſo conformable to fact; for upon it depend the inſtantaneous deaths in ſome caſes; tranſported infection in others; and fevers kindled up in others, from the ſubtil matter exhaling from ſuch fomes.

Beſides, if, from the heavineſs of the oxyd, it always has a tendency to the lower parts, then ſhips, through whoſe ſides it cannot leak out by reaſon of their tightneſs, ſhould be very apt to accumulate it; and this too correſponds with the fact; ſea-veſſels being among the chief agents in its production and diffuſion, the receptacles of its collected virulence, and the ſeats of its moſt deſtructive ravages. Cellars are noxious for the ſame reaſon.

It muſt be obvious, that the ſymptoms of theſe febrile diſeaſes, excited by the gaſeous oxyd, are diviſible into two claſſes. Sporadic caſes may occur, in which, from its production within the body, the ſtomach and bowels may chiefly labour, and in theſe will the ſymptoms firſt enumerated prevail, attended with

high

high excitement of the syſtem. Endemic ſickneſs may generally be expected, when, from an extrication of the gas in large quantity from ſome abundant ſource without the body, the contagion operates upon the lungs, and produces the ſecond claſs of ſymptoms, and in theſe will the pulſe be ſlow, and the heat moderate. The worſt caſes that can occur will be thoſe, where, both from external and internal cauſes, the ſtomach and lungs and ſkin are attacked at once, and afford a mingled aſſemblage of ſymptoms.

There has been much diſpute about the production of contagion, whether from animal or vegetable matter. The controverſy ſeems to me to be a trifling one. It is underſtood from analyſis, that the bodies both of plants and animals are compoſed of the ſame elements or principles, varying in their proportions, ſtructure, &c. It is known, for inſtance, that oxygene, which conſtitutes $\frac{37}{100}$th parts of the azotic oxyd, is very plentiful in moſt vegetable ſubſtances, and that ſome of them alſo contain a portion of azote, the ingredient forming the other $\frac{63}{100}$th parts. In ſuch caſes there can be no queſtion, that the oxyd might be produced during their decompoſition. It is likewiſe known, that animals contain a very great proportion of azote, and moſtly a moderate quantity of oxygene. There can be hardly a queſtion then, that the oxyd might be generated from decaying ſubſtances of this ſort. But as the one ſubſtance is highly charged with oxygene, and the other with azote, the mixture of the two ſeems moſt likely to afford the greateſt amount of oxyd, and this, I believe, is agreeable to fact. Pure animal matter will therefore perhaps be leſs likely to afford this oxyd than a mixture of it with vegetable. This explains why the ſtomachs of living perſons, containing commonly a mixture of the two kinds of food, and the abdomen of dead bodies are ſo prone to the production of it; and why ſlaughter-houſes, tan-vats, currying-houſes, works for making glue and Pruſſian blue, the horner's buſineſs, oil-ſhops, and manufactories of ſoap and candles are not remarkable for generating contagion. There is very little aceſcent

vegetable

vegetable matter employed there, and consequently the gaseous oxyd is sparingly formed. On the other hand, in vinegar-cellars, wine-presses, cyder-mills, and other places where much unmixed vegetable matter of the oxygenous kind is accumulated, no inconvenience arises, as there is little azote to join in producing the oxyd. I see, however, no improbability in the idea, that independent of animal and vegetable matter at all, there may exist in nature some mode of combining oxygenous and azotic airs. But I know of no such process at present.

This inquiry has brought contagion home to our doors, and traced it to its seat within our bodies. Henceforth much of the labour employed in tracing the origin of fevers in foreign places, and their introduction in ships to our own ports, may be considered as superfluous.

Causes enough exist among ourselves, at certain times, to engender the most noxious vapours. The study of the production, and diffusion of these from domestic and internal sources should most assiduously engage our attention. In doing this, we shall be employed in earnest, in counteracting as well as detecting this wide-spreading and terrible evil.

On this head I shall first speak of prevention, as it respects the stomach and intestines.

According to the theory delivered, the persons who live on vegetable food, or keep a lax belly, ought to have no disorder, or a very slight one. This conclusion is confirmed by facts in abundance. The advice given by the Arabian physicians to prevent the plague, enjoins the repeated use of acid fruits, as pomgranates, Seville oranges, lemons, tart apples, &c. but above all wine-vinegar in small quantities, &c. (Mead on the Plague, chap. ii.) Doctor Wade has established the efficacy of a vegetable diet, (Rush on Yellow Fever, 334.) and of water as a drink, as the best means of preventing the yellow fever in a hot climate. Mr. Howard has borne testimony of the benefit of low diet as a preventative of the plague; and it is reported, that during the famous plague described

ſcribed by Thucidydes at Athens, Socrates the philoſopher preſerved his life by means of ſlender diet, as did Juſtinian at Conſtantinople in a ſimilar caſe, by his abſtinent way of living. The avoiding of animal food, adhering to a low diet, and taking laxatives, was doubtleſs one of the means of preſerving the life of Dr. Ruſh, during the late calamity in Philadelphia; and what may ſerve as a hoſt of facts, in a word, it is related by Bontius, that the plague has never yet ſhewn itſelf among the natives (rice-eaters) of the Eaſt-Indies. Speaking of China, Dr. Mead ſays, "We have no inſtance of the plague that was originally bred in that country."

Here then, we have evidence of ſuch an extenſive and concluſive kind, as to ſatisfy even the ſceptical mind concerning the eaſe and poſſibility of prevention. By avoiding animal food azote is kept out of the ſtomach, the deſtructive gaſeous oxyd is not formed, nor are the inflammatory torments of the bowels felt. By keeping an open belly, the plan of ſecuring the health will be promoted, and no detention of feculent matter give riſe to flatulency and oppreſſion. I doubt whether the metallic rod will more ſecurely guard us from lightning, than vegetable food preſerve us from peſtilence.

As to the ſecond head of prevention, as it regards the production of the gaſeous oxyd in quantity ſufficient to contaminate the air and injure the thoracic viſcera, it forms ſo intereſting a branch of general police that it is needleſs to remark any further upon it than to ſay, while puddles of putrid naſtineſs, and piles of reeking dung are inceſſantly exhaling their poiſonous ſteams, that magiſtracy conſults very imperfectly the public health, which neglects the removal of ſuch common nuiſances. The city, as well as the individual citizen, wants a cathartic now and then; and by this plan, and by changing animal for vegetable food in the ſummer time, a world of ſickneſs and mortality might be prevented.

In the caſe of gas already produced, and pervading the rooms of a houſe, or the houſes of a neighbour-

 hood,

hood, as it is formed by a chemical procefs, it may be very rationally demanded, whether by fome chemical operation the gafeous oxyd may not be decompounded? It has been already ftated in the hiftory of the fubftance, that it refifted decompofition by fulphur, phofphorus, and cauftic alkali entirely; was but feebly attracted by charcoal; and that hydrogene was the only fubftance as yet known, having a powerful affinity to it. In what form this can be applied fo as to feparate the oxygene from the oxyd, and leave the naked azotic gas in the poffeffion of its ordinary harmlefs qualities, is a field for curious and ufeful inquiry.

Long ago has it been remarked, that our vices were the parents of our misfortune. Never perhaps was fentiment more forrowfully verified than in the prefent inftance. Our luxury and feftivity doom the inhabitants of air, earth, and water to death; and it feems as if, in revenge for our cruelty, this tormenting fpirit had arifen from their graves to plague us.

HITHERTO we have been ignorant of the precife nature of contagion; but fince we are become acquainted with its production and compofition, it is very much in the power of individuals to guard themfelves againft it, and for magiftrates to protect cities from its ravages. To what extent the principle now ftarted may be carried in explaining other difeafes, is not eafy to imagine. One can hardly fuppre∫s the conjecture, that the fame poifon which in a coftive habit of body caufes inflammation of the ftomach and dreadful fevers, will in a lax habit occafion cholera or diarrhœa, or in cafe the large inteftines be obftructed, terminate in dyfentery. How far it may, when operating on the lungs, concur in producing influenza and fcarlatina, is an interefting queftion. And this is particularly worthy of our notice, from the reafon and analogy of the thing, independent of the very remarkable and impreffive fact related by the elegant and judicious author of the account of the yellow fever in Philadelphia in 1793, who tells us, (p. 6.) that cholera, remitting fevers, dyfentery, influenza,

fluenza and ſcarlatina were the immediate forerunners of the diſorder he deſcribes; and that "in the courſe "of a few weeks (p. 89) they all diſappeared, or ap-"peared with ſymptoms of the yellow fever; ſo that "after the firſt week in September it was the ſolitary "epidemic of the city." The caſe of the girl immediately following this quotation proves the propoſition I am contending for to a demonſtration. There is reaſonable ſubject of inquiry too, how far in phthiſis in hot climates, and ſcrophula, may be derived from a like ſource.

The connection of this fever with other complaints is ſtrikingly exemplified in the following narrative: (Anſon's voyage, fol. p. 131.) But (ſpeaking of ſcurvy) ſays Mr. Walter, "it is not eaſy to complete the "long roll of the various concomitants of this diſeaſe; "for it often produced putrid fevers, pleuriſies, the "jaundice, and violent rheumatic pains, and ſome-"times it occaſioned an obſtinate coſtiveneſs, which "was generally attended with a difficulty of breath-"ing, &c. &c. At other times the whole body, but "more eſpecially the legs, were ſubject to ulcers of "the worſt kind, &c. &c." The evidence of analogy, too, ſtrongly favours the opinion, that other contagions and poiſons may conſiſt of the ſame materials, varying but in their proportions, or in ſome unimportant circumſtance, and that the virus of ſyphilis, ſmall-pox, and meaſles, and of the ſpider, rattle-ſnake, and other venomous creatures, as being all of animal production, may conſiſt in the main of azote and oxygene, combined perhaps with ſome other ingredient; and there is high probability that marſh miaſmata will be found little elſe than a ſimilar compound. The ichor of cancer and other corroding ulcers is very probable pretty much the ſame thing. The diſeaſe of rabid animals, and the dread of water, and other miſerable ſymptoms conſequent upon their bites, may very probably receive ſome light from this ſource; and ſo perhaps may ſibbens, yaws, and leproſy.

We have conſidered already what varied ſymptoms may be cauſed by the ſame matter operating upon

different parts of the animal frame. In all probability much of the difference obſervable in the operation of different poiſons, ariſe from the ſenſibility, irritability, ſtructure, and function of the part to which it is applied. This idea at leaſt ſeems to be countenanced by what we obſerve in the ſyphilitic virus, which, when applied to a ſecreting ſurface, cauſes gonorrhœa; to a dry one, chancre; to a glandular ſurface, bubo, &c. Who knows but a ſimilar exciting cauſe may, by operating upon the conſtitution, in one way produce continued, in another remittent, and in a third, intermittent fevers, which in reality differ from each other leſs in their cauſes than in the particular part of the body to which this cauſe is applied? The difference of the ſeveral fevers brought on by this gaſeous oxyd being chiefly connected with the viſcus or function injured by its action, it is to be underſtood, that if the liver is invaded, this may induce according to circumſtances an impeded ſecretion of bile, and then there will be a fever without yellowneſs, or an obſtruction of the gall-ducts, when, from an abſorption from the ſecreted fluid, there will be yellowneſs tinging the eyes or ſkin, or a vitiated ſecretion, appearing in the form of a green or brown matter vomited up. In like manner, when the lymphatic ſyſtem is the ſeat of its action, it may cauſe buboes in the glands; or when the ſkin is beſet by it, carbuncles, ſores, and miliary and petechial eruptions may break out. So likewiſe in the mouth and fauces aphthous ulcers, and eryſipelatous inflammation, a ſpreading perhaps of the original malady in the ſtomach, may all derive their origin from the ſame cauſe.

This method of conſidering contagions is entirely conformable to the ſimplicity of nature. The aſſignment of a multiplicity of cauſes, to account for particular phenomena, always betokens a backward ſtate of knowledge. The buſineſs of ſcience is to generalize facts, to claſs phenomena under diſtinct heads, and ſhow their dependance upon a common principle or cauſe. Accordingly, in the progreſs of human reaſon, polytheiſm has yielded to the conviction of the exiſ-

tence

tence of *one* God; the intricate and ſeemingly oppoſite phenomena of matter and motion have been referred to one general law of gravitation; the puzzling and diverſified appearances of electricity have been reduced to a few plain rules; the multitude of facts concerning light and colours have been in like manner arranged into a ſcientific form; and both the *rainbow* and the *teleſcope* bear witneſs to the ſimplicity of optics. The fluids compoſing our atmoſphere have been analized, and the influence of theſe, and of many occaſional combinations of other ſubſtances into gaſes, upon life and health been inveſtigated to their principles. Contagion alone has remained a ſubject for doubting and gueſſing; a diſmal ſomewhat, whoſe exact origin was unknown, and whoſe operation ſeemed capricious or unaccountable. This, I truſt, will now, like other agents in creation, be found to have its laws of production, diffuſion, and action, which are ſteady and unvaried in their nature, as well as ſimple and eaſy to be comprehended.

I was going into the practical conſiderations and directions reſulting from the principles laid down; but the ſubject was ſo extenſive, and materials flowed in upon me ſo faſt, that the work would very ſpeedily have extended far beyond the bounds I had now preſcribed to myſelf; and impreſſed as I was with the extenſive and beneficial application of this doctrine of contagion to every place upon earth where it is generated, and to every conſtitution upon which it acts, I felt a deep concern to make it public as ſoon as I conveniently could.

APPENDIX.

No. II.

On the uſe of the NITRIC ACID in Medicine, by Mr. W. SCOTT, Surgeon in ſervice of the Hon. Eaſt-India Company, Bombay.

The following attempt to extend a little the limits of the Healing Art, is inſcribed as a tribute of reſpect to the character of Doctor James Anderſon, Phyſician General of Madras.

IN Auguſt 1793, I employed myſelf for ſome time in making experiments on the bile, a ſecretion that is connected in a great degree with many of the diſeaſes of this country. I wiſhed to unite ſome of the calces of mercury, with the reſinous matter of that fluid, for I imagined that I might diſcover ſome chemical affinity between thoſe ſubſtances, and be able to ſee by what means this metal is ſo ſingularly qualified for removing obſtructions * of the liver.

I had collected for experiment a quantity of the reſinous baſe of the bile of a buffalo, which I had ſeparated very carefully from its ſoda, and from the lymphatic matter with which it is united. I had put a drachm or more of this ſubſtance into a veſſel, to which I added about half of the ſame weight of the red calx of mercury, with ten or twelve ounces of water. On heating the whole together, I was ſurpriſed to obſerve that the baſe of the bile became remarkably more ſoluble in the water. I cannot ſay that

* I have uſed the word obſtruction to expreſs the chronic diſeaſe of the liver ſo common in this country.

that I obſerved the red colour of the calx in any great degree altered, but it is known to retain its brilliancy with different quantities of oxygene†. I filtrated this bitter ſolution which depoſited the baſe of the bile, as the water evaporated in the ordinary heat of the atmoſphere. I ſhall at another time conſider this ſubject with a little more attention.

M. Fourcroy has obſerved, that water diſſolves a ſmall portion of the baſe of the bile. In this experiment a conſiderably larger quantity was taken up than water could have diſſolved, which I attributed to the oxygenation of the reſin, by the pure air of the calx. I had ſome reaſon to think, that obſtructions of the liver do often conſiſt of a depoſition of the reſin of the bile, which I now began to ſuppoſe, might be rendered ſoluble in the animal fluids, by the pure air of the mercurial preparations that are given for the diſeaſe. I have ſeen livers on the diſſection of the dead, of a pearl colour, and much enlarged, which I ſuſpect were compoſed in a good meaſure, of this reſinous matter. I have even found it from accurate trials in a conſiderable quantity in the ſubſtance of a liver, that was apparently without diſeaſe: Is the well known effect of new graſs, in diſſolving the biliary calculi of the gall bladder, that cattle get in the winter time, to be accounted for from the pure air of green and aceſcent vegetables?

It is acknowledged, that all the calces of Mercury which are uſed in medicine, contain a quantity of pure air, but I know of no direct experiment having been hitherto made, to prove that the effect of mercury in diſeaſes of the liver or in other maladies depends on this principle, and not on the metal itſelf. The experiments that I had made on the baſe of the bile, inclined me to wiſh, to take myſelf a quantity of pure air united to ſome ſubſtance, for which it has no great attraction. I reflected on the different ways that are employed by chemiſts to oxygenate inanimate matter; for I believed, that the ſame chemical attractions

† See experiments by Van Mons on the red oxide of mercury.

tractions would produce a similar effect in the living body, although they might be disturbed in their operation, by the vitality of the machine, and the variety of the principles of which it is composed.

The nitric acid as may be supposed, was one of the first substances that occurred to me as fit for my purpose, for it is known to contain about four parts of vital air, united to one of azote, with a certain proportion of water. These principles can be separated from each other, by the intervention of many other bodies, as chemists find every day in their operations. I was led besides to give a preference to the nitric acid from observing, that it dissolves very completely the resinous base of the bile: I have since found that the celebrated M. Fourcroy had made the same observation before me.

Before I began to take the nitric acid, I consulted all the accounts of it that I could procure, with the view of learning something of its effects on the human body. The result of this inquiry was but little satisfactory, for I only found that it had been given as a diuretic in very insignificant quantities, or recommended in general terms, where the mineral acids are supposed to be useful; I did not think myself warranted to administer it to others from such imperfect information, but I resolved to take it myself, and I thought I was particularly qualified to determine its effects, as I had reason for a long time before to complain of my liver.

In September 1793, I began to take the nitric acid: I mixed about a drachm of the strongest that I could procure, with a sufficient quantity of water, and I was happy to find, that I could finish that quantity in the course of a few hours, without any disagreeable effect from it. The following is the Journal that I kept of myself at the time.

11*th September*, 1*st Day*.—Took at different times about a drachm of strong nitric acid diluted with water. Soon after drinking it, I feel a sense of warmth in my stomach and chest, but I find no disagreeable sensation from it, nor any other material effect.

2d.—I have taken to-day a conſiderable quantity of acid, diluted with water, as much as I could eaſily drink during the forenoon.

3d.—I have continued the Acid: I feel my gums affected from it, and they are ſomewhat red and enlarged between the Teeth. I ſlept ill, but could lie for a length of time on my left ſide, which from ſome diſeaſe in my liver, has not been the caſe for many months before. I perceive a pain in the back of my head, reſembling what I have commonly felt when taking mercury.

4th.—My gums are a little tender: I continue the acid as before. I ſtill find a pain in my head and about my jaws, like what ariſes from mercury. I perceive no ſymptoms of my liver complaint.

5th.—I have taken the acid, and always feel an agreeable ſenſe of heat after drinking it. I ſpit more than uſual.

6th.—I continue the acid: I obſerve my mouth ſorer to-day, and ſpit more.

7th.—I think I am now ſufficiently oxygenated. I feel my mouth ſo troubleſome, that I ſhall take no more acid.

From this time my mouth got gradually well, and I found my health conſiderably improved.

I now began to ſuppoſe that I had diſcovered a remedy for that chronic diſeaſe of the liver, which is ſo much more common here than the acute hepatitis. I thought that it might in ſome reſpect be preferable to mercury, as it did not appear to produce the inconveniences that ariſe from the uſe of that metal. I have given it ſince to a number of people who had taken mercury for hepatic obſtructions, without being effectually cured, and I have found it in many caſes produce the moſt agreeable conſequences. If it were proper on this occaſion to be more particular in detailing the caſes, in which I have adminiſtred this remedy, I believe that I could make it very probable that I have not been deceiving myſelf. In the acute hepatitis I have hardly employed it, for where the life of a perſon is in immediate danger, I have thought it my duty to make uſe of remedies that are eſtabliſhed.

 I have

I have with the beſt effect oxygenated ſeveral people with the nitric acid, who were much reduced by tedious intermittents. That kind of fever is often connected with a diſeaſed liver or ſpleen. In conſequence I think of this remedy, I have ſeen them recover their natural colour from a leaden or bilious hue, and regain their ſtrength from a ſtate of long continued weakneſs. I believe, if given in a ſufficient quantity, it would be very uſeful in the fever of this country, which has been called bilious, or nervous or putrid, and for which mercury appears to be a ſpecific.

I have met with two inſtances only in this country of diabetes:—They were both natives and in the decline of life; I cured them both by mercury, after many other remedies had been tried:—One of thoſe men had a relapſe of his diſeaſe, which I removed a ſecond time with the nitric acid. I thought this a ſatisfactory correſpondence in the effects of the two remedies—May they not both be uſeful in that diſeaſe?

The great reſemblance that I perceived in myſelf between the effects of mercury and of the nitric acid, made me anxious to know if the acid would remove the various ſymptoms of ſiphylis. In September 1793, it was adminiſtred at my deſire by my friend Mr. Anderſon, Surgeon of the 77th Regiment, to a perſon who had a head-ach that came on every night, and which had long been ſuſpected to ariſe from lues. He had taken ſeveral courſes of mercury on this account, which carried away all the uneaſy ſymptoms, but they as conſtantly returned after a certain period. On uſing the acid for about a fortnight, he got perfectly free from his head-ach, and he remained very well for a few months, as was uſual to him after mercury.

I have now had a pretty extenſive experience of the good effects of the nitric acid in ſiphylis, and I have reaſon to believe, that it is not in general leſs effectual than mercury, in removing that diſeaſe in all its forms, and in every ſtage of its continuance.

I think

I think that in ſome caſes, it has even ſuperior powers, for I have ſucceeded completely with the acid, when mercury adminiſtred both in this country and in Europe for years together, had failed of ſucceſs. We appear to be able to carry the degree of oxygenation of the body to a greater length by means of the nitric acid, and to continue it longer than we can do by mercury.

A maſs of mercury in the circulation produces many diſagreeable effects, that make it often neceſſary to give over its uſe before it has anſwered it's intention; but the nitric acid may be taken a long time without any material injury to the health, nor are its effects on the mouth in producing inflammation and a flow of ſaliva ſo diſagreeable as from mercury.

A man could hardly offer to his ſpecies a greater bleſſing than a new remedy againſt any of the hoſt of diſeaſes that aſſail us, but the reputation of ſpecifics with the exception of a few inſtances, has ariſen only from the weakneſs of the human mind. Am I too deceiving myſelf, and attempting to lead others into error?

As the acid that I diſtil is not ſtrong, and is of unequal ſtrength at different times, I am regulated chiefly by the taſte in giving it. I put half or three fourths of a Maderia-glaſs full of it in two pints of water, or I make two pints of water as acid as it can well be drank. This quantity is finiſhed every twenty-four hours, taking about a Maderia-glaſs full only at a time.

I have ſometimes removed ſiphylitic ſymptoms with the acid in five days; more commonly I think, they give way in a fortnight; but ſometimes, though ſeldom, they continue for twenty days without any apparent relief. I muſt confeſs, that in ſome caſes I have failed altogether, but in thoſe caſes mercury had long been given to little purpoſe, the bones were highly diſeaſed and the habit probably of a peculiar kind. I have cured ſiphylis with the acid under a variety of forms, where no other remedy had ever been

been employed, and for above two years I have seen no relapse in those cases. I have administred it against the primary symptoms of the disease, and I have given it for exostoses, for carious bones, for nocturnal pains, for eruptions and ulcers of the skin, and for all the train of misery that is attendant on lues. I have the pleasure to see that several of my friends have begun to use the nitric acid in siphylis and in other diseases: An account of their experience which every body will esteem the most respectable authority, will make the subject of a future paper.

I hope this slight account will induce medical practitioners to try the effect of the nitric acid in siphylis, a disease which in this climate is so frequently the disgrace of their art—Too often the miserable wretch is but worn down the sooner by the very remedies that are called in for his relief.

> Quaesitæque nocent artes; cessere Magistri,
> Phillyrides Chiron, Amythaoniusque Melampus.
>
> Virg: Georg. III.

APPEN-

APPENDIX.

N°. III.

Caſe of diſeaſed Bladder, by Mr. BAYNTON, Surgeon, Briſtol.

Dear Sir,

AS the ſucceſs that attended the treatment of the following diſeaſe may be referred to a hint offered in your Treatiſe on Sea Scurvy, Calculus Conſumption, &c. I take the liberty of ſending you its hiſtory.

On the 14th of September, 1794, in the evening, I was requeſted to meet a Mr. Lawrence who at that time practiced as a Surgeon and Apothecary in the environs of this city, to *inveſtigate* the caſe of a perſon of very robuſt make and about thirty years of age, who had applied to him a few weeks before for the cure of a Gonorrhæa which he informed me he had treated in the uſual way, with injections &c. but that diſtreſſing ſymptoms had been daily increaſing and for ſome days had been nearly as violent as they then were. He complained of a very ſevere pain and tenderneſs to the touch about the region of the pubis and along the perineum, and paſſed his urine with great pain and difficulty by drops, and with it a large quantity of peculiarly viſcid mucus that was ſometimes tranſparent, at others bloody, but always ſo viſcid that it was with difficulty waſhed from the ſides of the veſſel in which it was received. His pulſe were remarkably hard and full and beat 110 ſtrokes in a minute. He had conſtant teneſmus and had not ſlept for many nights, by my deſire he was bled to the amount of 14 ounces. Twelve leeches were applied upon the hypogaſtrium and about the verge of the anus.

anus. He had an opening medicine and the following anodyne as ſoon as the opening medicine operated:

℞ Tinct: Opii: gutt: xl Vin: Antim: gutt: xxx Syr: Papav: Albi: Drachm. i. Dec. Hord: comp: Unc: iſs.

On the morning of the 15th he was in no reſpect better; the opiate failed to give eaſe. The pain of diſcharging urine and the teneſmus were equally violent, and nearly half a pound of mucus had been diſcharged from the bladder in the courſe of the night. The draught was repeated with the addition of 10 drops of the Tinct. Opii. and the abdomen was directed to be well fomented with flannels, wrung out in a decoction of poppy heads, every fourth hour. In the evening we found him nearly in the ſame ſtate, except that the mucus diſcharged appeared to increaſe. An injection of the Dec. Amyli. with Tinct. Opii. was now directed to be thrown up the rectum in the hope of procuring him ſome eaſe; but it failed to afford even temporary relief, and he evidently became worſe every day. On the 18th he was directed to take half a drachm of the Pulv. Uvæ Urſi. three times a day, in a draught of the compound decoction of barley. The opiate was continued, and various other remedies, as bark, balſam of copaiva, &c. were exhibited with no advantage, until the 28th, when his ſituation appeared ſo deplorable, that neither Mr. Lawrence or myſelf expected he could ſurvive many days. I happened at that time to recollect, that you had ſomewhere obſerved, that the good effects of the aqua alkalina mephitica could not be referred merely to its ſolvent property, as relief was, in many caſes of calculus, experienced ſoon after the remedy was taken into the ſtomach; and as your obſervation ſeemed to imply a ſedative effect, that I had not before ſuppoſed it to poſſeſs, I propoſed as a laſt and forlorn reſource the trial of it. It was determined that he ſhould be immediately put upon its uſe; but when it was conſidered, how much time would be expended in its preparation, we were obliged to reſign the idea, as the poor man appeared to be too near his end

end to admit of the neceſſary delay. His pulſe was now ſo ſmall as to be ſcarcely perceptible, and ſo quick as to make it difficult to reckon them; the mucus drain varied from two to three pounds in the day and night; and to his pain, which was very great at all times, but extremely ſo upon the contraction of the bladder after the diſcharge of either mucus or urine, and to his other bad ſymptoms, were now added colliquative ſweats,—all of which when conſidered induced a belief, that he could not ſurvive till it could be prepared. I then thought of the ſubſtitute that had been propoſed by you for thoſe to whom the *aqua alkalina mephitica* could not be rendered on account of its expenſiveneſs. I mentioned it to Mr. L. and it was concluded that he ſhould take it till the other medicine could be prepared, if he lived ſo long. Accordingly, two drachms of the dried ſoda was mixed with an equal quantity of the beſt ſoap, 12 drops of the eſſential oil of nutmegs, and the maſs when made up with ſyrup was formed into 48 pills. He was directed to take four of them three times a day in a draught of the D: Hord: comp. At our viſit on the morning of the 29th, when he had taken only three doſes of his pills, we learnt with pleaſure and ſurpriſe, that he had ſlept a little in the night, and that his calls to diſcharge urine had not been ſo frequent; and, in ſhort, we ventured to hope that he was ſomething better; our viſit at night confirmed the hope of the morning. On the 30th we were told that he had ſlept more than he had done the preceding night, that the pain was abated, and that all his bad ſymptoms were alleviated. The next day (Oct. 1.) we were gratified by further proof of amendment: the mucus diſcharge was much diminiſhed, the waſting ſweats not ſo profuſe, and his appetite beginning to return. From that time every thing went on well; and by the 13th of the month every inconvenient ſymptom, except an inability to retain ſo large a quantity of urine, as he had been accuſtomed to do, previous to the inflammation of his bladder, and except ſome remaining weakneſs, had compleatly left him. He has con-

continued free from any return of ſuch indiſpoſition to the preſent day.

I have thus given you the hiſtory of a diſeaſe, that, in this inſtance, afforded a hopeleſs proſpect, and that but too often diſappoints the beſt directed efforts of the moſt ſkilful Practitioners; but which I am inclined to hope and expect, not only from the event of this remarkable though ſolitary caſe, but alſo from analogous effects in ſome that have ſince fallen under my obſervation, where the action of the membranes of the bladder appeared to be ſimilar, and where the ſame kind of diſtreſſing ſymptoms were experienced, but where examination proved the exiſtence of a diſeaſed proſtate in one inſtance, and calculus in two others,—that if the medicine be further tried, that a ſimilar reſult will follow. Should it prove ſo, an additional remedy in one of the worſt diſeaſes will be added to the preſent limited number of thoſe that *appear* to produce uniform and ſpecific effects.

BRISTOL,
Auguſt 24, 1796.

I am, Dear Sir,
Yours,

THOMAS BAYNTON.

APPENDIX.

No. IV.

Dear Sir,

If all the circumſtances of the following caſe were detailed, they would perhaps juſtify the ſanguine expectations that I ventured to acknowledge I had formed of the almoſt infallible efficacy of the Soda Pills, from what I had obſerved of its effects in one caſe of dyſuria mucoſa that I gave to you at length, and ſome others that I hinted at in the cloſe of the Letter that contained that communication; but I am at preſent ſo circumſtanced as only to be able to give you an outline of the caſe, and a general account of the means that were made uſe of whilſt he was under my care: I am however enabled to give additional weight to the relation, by the mention of his name; as he has very frequently ſolicited me to make known a remedy that he conſiders as having preſerved him from an untimely Death.

Mr. John Henderſon, of the Pariſh of St. George, Aged 55, requeſted me to attend him at his Houſe at the beginning of Auguſt laſt, for a complaint of the Bladder and Urinary paſſages: Upon enquiring into his ſymptoms and examining the parts, I learnt that he had paſſed his water with pain and difficulty upwards of Seven Years, and that for a conſiderable time he had diſcharged more or leſs of that mucous material which I believe it is the peculiar and excluſive province of the membranes of the bladder to ſecrete; I alſo diſcovered that about midway between the ſcrotum and the Anus there was a conſiderable fulneſs of the perineum, and that one ſide of the ſcrotum was larger than the other in conſequence of a thickening of the Tunica Vaginalis, upon which I enquired if he had at any time received a blow or other violence upon thoſe parts; he told me that about ſeven or eight Years before, he recollected to have fallen

when on ſhipboard, upon that part of the ſhip that is called the rough tree, and that as thoſe parts were then ſtruck he thought it poſſible, tho' he felt but little pain at the time, that the foundation of the injury might have been then laid, more eſpecially as he had ſince that time been ſubject to Hydroçele, and had been tapped twice on that ſide of the ſcrotum which I had obſerved to be thickened; this led me to enquire what aſſiſtance had been afforded him, and by whom it had been rendered; he mentioned the names of four Gentlemen that had attended him *ſingly* the greateſt part of the time that he had been indiſpoſed; he ſaid that he had taken ſo immenſe a quantity of medicine with ſo little advantage, that he had determined never more to apply to any medical Gentleman, and had been prevailed upon to conſult me againſt his inclination by the importunity of a friend.

Such an account would have diſcouraged me if he had mentioned the names of Gentlemen that I had not known, at a ſeaſon like the preſent when the ſources of information are acceſſible to all; but as it happened that I was perſonally informed of the ſuperior ability of thoſe that had been conſulted, I could not but have deſpaired of being able to afford him any aſſiſtance if I had not been ſo lately convinced of the powers of the Soda in ſimilar caſes. Symptoms of ſtricture in the Urethra induced me to endeavour to paſs a Bougie; and I diſcovered that the canal was obſtructed by the tumor in the perineum; the information thus obtained, induced me to conſider the affection of the bladder as a mere ſympathetic action that was kept up by the irritation that was given to the Urethra and the Bladder by the tumor in the Perineum; I therefore applied Leeches to it as often as the Patient's ſtrength would allow, and attempted by the application of cold and other auxiliaries to procure its reſolution; the event was contrary to my expectations, and a diſeaſe that had ſo long remained in an indolent ſtate became active and ſuppurated ſoon after the above means were applied to produce its reſolution; it was allowed to break, as it pointed in a depending part, and after

a confiderable flough had feparated (tho' the Urine paffed for fome days through the wound) in the courfe of three or four weeks it healed, with no other treatment than light fuperficial dreffings and frequently repeated warm poultices applied over them; the obftruction was now removed, and I hoped the effect would ceafe as the caufe no longer exifted, but in this alfo I was miftaken, as it was afterwards continued by Habit, as Mr. Hunter would have faid, and much pain experienced with frequent and diftreffing Mucous difcharges. It will not be wondered even by thofe who have feen how much I have been indebted to the Soda that I ftill fhould fuppofe Opium the beft adapted remedy for *pains* that were occafioned by an obftruction in the Urethra, or that I fhould pertinacioufly continue to exhibit it with the hope of its *alleviating* my Patient's fufferings; but I am obliged to declare, that although fome relief was obtained by its ufe, I was compelled by the progreffion of the difeafe to apply again to the Soda: Again its good effects were aftonifhing, and by its ufe alone the Patient, after trying under my care many remedies, and under the direction of the other Medical Gentlemen, *perhaps* all that fcience could fuggeft, has been reftored to his Family in almoft perfect health, with no other remaining inconvenience than a flight difpofition in the difeafe at times to return, which his pills always remove very foon after they are taken. Any other particulars Mr. H. will at any time be happy to fatisfy you in.

I am, Dear Sir,

Your fincere Friend and Servant,

THOMAS BAYNTON.

Nov. 6, 1796.

NOTE by the EDITOR.

I Formerly publiſhed (*Obs. on Calculus. Murray.* 1792. *p.* 24.) the caſe of Mr. D. Lloyd, who had intenſe fixed pain in his loins, and diſcharged mucus with his urine, but never any gravel; and was wonderfully relieved by ſal ſodae. That caſe, wits the two preceding, render it probable that alkalis in relieving calculus, act on the mucus membrane rather than as ſolvents; and they would much confirm the opinion of Drs. Darwin and Auſtin on the nature of calculus, if the opinion needed confirmation. In the *Med. Commentaries* for 1795 there is an account of a diſeaſed bladder with mucus diſcharge, cured by injections—firſt, of oil and lime-water with watery infuſion of opium, and afterwards of ſolution of vitriol of zinc and mucilage with infuſion of opium. In that caſe alkali does not, from the account, appear to have been tried. It would probably have ſucceeded, and ſhould always be exhibited before recourſe is had to injections into the bladder.

APPENDIX.

No. V.

NOT many days after the receipt of Mr. Scott's paper on nitric acid (No. II.) the Editor was consulted on a singularly obstinate case of supposed Lues Venerea. Above ten months ago, the patient had slight gonorrhœa; and after the use of some common remedies he thought himself nearly well, when a small ulceration appeared on the *glans penis*. I am not informed whether this ulcer shewed the characteristics of chancre; but by the advice of an experienced practitioner, he now took the mercurial pill night and morning, and rubbed in mercurial ointment. This course was continued for near eight weeks without any soreness of the mouth, or amendment of the ulcer. In about four months from the first seizure, under the continuance of the same plan, an ulcer appeared in the throat, and the medicines were exhibited more largely for six weeks—and he was at the end of this time rather worse than better. The patient was now confined to his apartment, and mercury used more vigorously in both ways. In the course of five weeks the ulcer was reduced to a third of its former extent; its pain had subsided, and the gums felt slightly sore. After this time, the chancre(?) was in a fluctuating state, sometimes healing rapidly, and then spreading to its original dimensions; nor was any farther advance made towards a cure, though corrosive sublimate was employed alternately with other preparations of mercury. Eight months after the first attack, there was observed, near the sore, a gangrenous spot; having nothing of the appearance of a spreading venereal ulcer, but exactly such as is sometimes seen after long mercurial courses. The mercury was reduced; cicuta applied, and taken with bark and sarsaparilla; a grain only of calcined mercury being given at night, with half a grain of opium.

The Editor produced Mr. Scott's paper, and recommended a trial of his method, to which the patient and his friends chearfully consented. The nitric acid was accordingly taken with perseverance for six weeks, and for a time to 200 drops a day. Meanwhile the ulcer rather extended than diminished; its surface looked cleaner, but no tendency to incarnation appeared. Immediately on taking the acid no sensation was felt in the stomach, either pleasant or otherwise, except during the first, second or third days, when it griped a little—No increased warmth of the skin—no effect on the pulse. The night-sweats (which were certainly less after the mercury was reduced, and the bark and sarsaparilla employed) declined rapidly, after the acid was begun upon.

The acid being now gradually reduced to 80 drops a day, its inefficacy in this case became too apparent. The ulcer suddenly put on a worse appearance, and increased rapidly. Inflammation of the sound part of the glans, and a degree of phymosis succeeded.

Opium with bark has been since advised upon the supposition that the ulcer is a mere ill-conditioned ulcer, and now no longer of a venereal nature, whatever it may have been before the employment of mercurial medicines.

CASE *of* Mr. H.

Dear Sir,

I RECEIVED your obliging favour on the day it was written, and perceive by its manner that you are as much and as agreeably surprized by the information Mr. H.'s Letter to me affords, as I expected you would be. I think with you that the Public ought to be made acquainted with the history of his case, together with the contents of his Letter; and as I have personally witnessed what he has recorded, I should have to accuse myself of inhumanity, if I were to suffer any personal considerations, that respect either my time, or my unwillingness to appear so often as a narrator of uncommon cases in one pamphlet, to prevent my furnishing you with all

all the particulars within my knowledge. I therefore with cheerfulneſs and pleaſure undertake to give you, as far as I am able, with the aſſiſtance of my day-book and recollection, the account of a caſe that you ſay will conclude your pamphlet, "and make a noble concluſion." But as it may be aſked how I came to be acquainted with the effects of the remedy before its publication, it may not be amiſs for me to ſtate that, when Mr. Biggs, your Printer, furniſhed me with the proof-ſheet for reviſion that contained the account of Mr. Henderſon's caſe, I was ſtruck with Mr. Scott's communication which occupied the preceding part of the ſame ſheet; and as ſoon as an opportunity permitted, I informed you that I had a venereal patient under my care, whoſe caſe had reſiſted mercury in almoſt every known mode of exhibition, and that I ſhould wiſh to try the nitric acid as there recommended, and requeſted that I might be favoured with your company when I viſited the patient the next morning, as well to aſſiſt me with your opinion reſpecting the appropriate doſe, &c. as to give you a demonſtration of the caſe being almoſt as bad as ever had been obſerved by any practitioner. You obligingly promiſed to be with me at nine in the morning; but about that time I received a note from you, wherein you informed me that a profeſſional hindrance would prevent your being with me, and that upon reconſideration you thought the reaſoning of Mr. Scott, who refers the advantages obtained "to oxygenation of the ſyſtem," ſo unſatisfactory, that you would adviſe a very doubtful prognoſis to be given to the patient, if he were put upon a trial of it. I was ſo much influenced by your opinion, that I ſhould have omitted to make uſe of it, had I not the preceding evening ſhewn my patient Mr. Scott's account, and told him that he might expect a viſit from you in the enſuing morning. A man in his ſituation, that had for nearly two years experienced the inefficacy of what he had been frequently told was the whole of the known remedies that the art afforded, was not likely to give up the uſe of that which was aſſerted to be a tried remedy

in another part of the world, though it was unknown in this; and although I made him acquainted with the contents of your note, he was no way discouraged, but earnestly petitioned for its immediate exhibition. I have thus stated in a plain and candid manner the way in which I was led to its use. And if there should be any person, who, after what has been said, can suppose that any mistake in the nature of the case, or misrepresentation of the facts can have happened—or (which is more agreeable to believe) if any gentleman should wish to ascertain in a more particular manner the facts that preceded and accompanied the administration of a remedy of so much apparent importance in a disease so hopeless, I am happy to say, that my patient's very laudable humanity would induce him to sink the consideration of what he might feel in satisfying such enquiries, in the hope of assisting by his confessions some unhappy fellow sufferer.

On the 8th of February 1795 I was requested to visit Mr. ——— with pains of the limbs and ulcers of the throat and tonsils, which from appearances suspecting to be a case of cynanche maligna, induced me to prescribe bark wine, and gargles. That plan was persevered in until the 19th without any advantage. From that circumstance, conjoined with the situation of his pains and the times of their aggravation, I began (though my patient was married, and the father of healthy fine children) to suspect the case to be venereal; and after expressing my suspicions, I learnt from him that he had contracted such a disease some years before, and had at that time an ulcer on the penis; but that he supposed himself perfectly cured, having passed through a regular course of medicine for that purpose: it was with difficulty that I convinced him that his present sufferings were referable to such a cause. However, possessing his confidence, I prevailed upon him to commence a mercurial course, and he continued to take from that time to the 8th of March a grain of calomel, with an equal quantity of the ext. papav. three times a day, in the third part of a pint of the decoct. lignor

lignor cum rad. mezerii. On that day, in consequence of the appearance of some eruptions, the form of the medicines was exchanged for the following

℞ Hydrarg. Muriat. gr. iv.

Aq. cinnam. ℥iv. *m* cap. coch. larg. noct. maneq.

This was continued until the 27th of April, and then a drachm of the ung. hydrarg. fort. was ordered to be rubbed into the thighs every night at bed-time, and the former medicine omitted on account of the eruption having yielded, though the pains had increased: this, with the decoction of the woods and mezerion, was continued till the middle of June. On the 20th of October he began to take four grains of the blue pill with a quarter of a grain of opium three times a day; and it was continued without intermission until the middle of January 1796. On the 14th of that month calomel with opium were again used in its stead, and continued until the middle of February. On the 12th of July he again commenced its use, and continued to take it until the middle of August last, when I was obliged by the fullest experience of the inefficacy of all the mercurial preparations that had been tried, to again request him to desist from the use of all medicines, except occasional opiates to mitigate his pain, which it had been necessary for him to use with the greatest freedom during the whole of the mercurial course. It will here be necessary to remind you, that when I first was called to his assistance I found him labouring under only the constitutional or secondary symptoms of the disease; and as I did not keep any minutes of the case, I cannot speak with that exactness I would wish of the particular effects of the different preparations of mercury that were exhibited. But I have the fullest recollection, that the ulcers of the throat and the affection of the skin were removed in due time by the means that were adopted: and although there was a complete failure in my attempts to dislodge the poison from the bones, I am not convinced that the failure resulted from the incompetency of the mercury to produce such an effect—as the constitution of this patient was rendered

so

ſo irritable by the diſeaſe, or the means made uſe of, (or perhaps both) that I was never able to impregnate the ſyſtem with a ſufficient quantity to produce the deſired effect; though it was exhibited with every precaution, and united with every corrective that my judgment could ſuggeſt, conjoined with the advantages of country air, bark, milk diet, and the occaſional omiſſion of all medicines, which for a time anſwered ſo well, as to make my diſappointment the greater at each time of the diſeaſe returning. At laſt, medicine of almoſt every kind failed to afford even relief, and I was reduced to the neceſſity of being content with the mere palliative effects of opium given in large doſes. The peculiarities of this caſe are however too common; and every practitioner that is much engaged in a large city, eſpecially if it be a ſea-port, muſt have had to deplore ſuch occurrences. It was my good fortune to meet with Mr. Scott's communication, in the way before deſcribed, juſt at the time when I had exhauſted my endeavours to cure this patient—and when I ſay with him, that he was indeed a "rueful ſpectacle," with little more than diſeaſed bones remaining, when he began the uſe of the nitric acid; and that he now appears in good health, I contemplate with aſtoniſhment the change that has been produced: more eſpecially as he was always labouring under profuſe ſweats, diarrhœa, or ptyaliſm, from the mercurials that were exhibited, though they were ſo guarded; and has now obtained a cure by the uſe of a moſt powerful acid, without experiencing even momentary inconvenience, and in leſs time than would have been requiſite to remove even the mildeſt ſymptoms of the diſeaſe by any other known method. How much will the pleaſure, that the effects here related have afforded me, be increaſed, if the future experience of my profeſſional brethren ſhould coincide with what was obſerved in this very melancholy caſe: and that it may prove ſo in caſes that are ſimilar I entertain the greateſt hope, as the effects appeared to depend ſo fully upon the aſſigned cauſe, that no doubt can poſſibly remain upon my own mind of the acid being the true and only cauſe of the changes that followed. It will be recollected that the poiſon had in this caſe

obſerved its accuſtomed laws, and after traverſing the ſyſtem, and ſucceſſively diſplaying its character upon the genitals, fauces, and ſkin, it had affected the bones; from whence moſt practitioners have found it difficult, and ſometimes impoſſible, to diſlodge it. Perhaps it may not be difficult to conceive that a remedy, poſſeſſing ſuch chemical power, and having ſo ſtrong an affinity for the matter that analyſis tells us conſtitutes bone, may produce a cure in this ſpecies of the diſeaſe, and not be attended with equal effects where only the ſoft parts are affected by the poiſon. That this ſtage is the moſt difficult to remove, and that it is often impoſſible to accompliſh it, I have before ſaid, is known to moſt practitioners. May this remedy ſupply the deſideratum of this branch of the healing art, and the name of your correſpondent Mr. Scott will then be deſervedly remembered by every friend of ſcience and improvement. Why ſhould it be ſo difficult to believe the exiſtence of other ſpecifics for the poiſon in Europe, when it is recollected that the South-ſea iſlanders, and ſome tribes of the native Americans have found in the vegetable productions of their countries remedies for the worſt ſtates of the diſeaſe?

I have thus endeavoured to comply with your requeſt as fully and particularly as the circumſtance of my having kept no minutes of the caſe will allow me; and as the recollection of the patient will be long kept alive by what he has ſuffered, I think that his own letter may be as ſatisfactory as any account from me of the ſituation he was in, when he firſt made uſe of the medicine that has occaſioned his cure. And I can ſafely aſſert that I believe his account to be a moſt faithful repreſentation of his ſituation. You have ſeen it in his own writing, and he has been taught to expect a viſit from you. I therefore requeſt that you will at an early interview with him oblige me by ſatisfying yourſelf of the whole of what is here aſſerted; and then, if it be in time for your pamphlet, ſubjoin your teſtimony to that of

Your ſincere Servant,

Nov. 28, 1796. THOMAS BAYNTON.

To Dr. BEDDOES.

DEAR SIR,

PURSUANT to your requeſt at your laſt viſit, I take my pen to deſcribe (if poſſible) the deplorable condition and ſufferings I have endured for near two years laſt paſt, and the almoſt miraculous deliverance therefrom by your care and unwearied attention thereto.——I was firſt ſeized with ulcers of my throat and violent pains in my ſhins at night, that threw me into ſuch perſpirations, that for nine or ten mornings I was under the neceſſity of changing my linen before I could poſſibly get up; which was ſoon followed by or with excreſcences or nodes from my knees almoſt down to my inſteps, attended with violent pains in my head. My arms alſo were attacked with excruciating pains, where ſwellings of a conſiderable ſize made their appearance. My knees alſo ſwelled, and the pain ſo acute, that I durſt not move them the leaſt aſide: ſleep fled—nor did it return for ten weeks. And for twenty-two weeks I could not bear to be moved without ſuffering the moſt extreme torture, notwithſtanding your tender care to adminiſter every thing you could deviſe and preſcribe for my relief. I knew you perfectly underſtood my caſe; but my diſeaſe ſeemed to baffle the power of medicine and every effort. Having for the then laſt thirteen weeks lived wholly upon milk, you adviſed me to diſcontinue the medicine, in hopes I might ſoon be able to make uſe of ſtronger food, and recover a little ſtrength. This treatment had the deſired effect: and my pains for ſome time ſeemed to abate; but, alas! they ſoon returned again! when you adviſed another courſe of medicine, which operated more powerfully than it hitherto had done, and in a few months reſtored me ſo as to enable me to walk from my lodgings in the country to town. The ſatisfaction you expreſſed on the occaſion I ſhall never forget, and with myſelf was in hopes of a radical cure. But at the end of three months my hopes were deſtroyed by a violent relapſe, which ſoon confined me to my bed. My legs (if poſſible) were worſe than before; for

for not only my ſhins, but the main bones pained me dreadfully. One node formed (a little below my right knee) in a ſhort time almoſt as large as an hen egg. The pains from my ſhoulders to my fingers ends I can ſcarcely deſcribe. The ſinews of my arms, thighs, and legs ſtiff and contracted—my fingers I could by no means bend; they were fixed by diſeaſe, and every joint ſwelled. The bones of my head ſhared equal with the parts I have deſcribed; and nothing but death was expected to put a period to ſuch a ſcene of miſery. Added to this, my body was a rueful ſpectacle, a mere ſkeleton; ſo that diſeaſe had nothing left but my vitals for its prey. This, Sir, is a faint deſcription of the ſtate and condition you found me in about three weeks ago, when you viſited me, and with joy in your countenance told me, a new diſcovery had been made of a medicine that you had great hope would reach my caſe; and with your wonted goodneſs of heart cheered up my drooping ſpirits by deſcribing to me its mildneſs and efficacy in ſeveral caſes ſimilar to my own. Encouraged by this information, and relying upon your judgment, I was determined to give it a fair trial. I began, and continued to take the quantity as preſcribed.—At the expiration of ſeven days I found it begin to operate, as you had before deſcribed, by creating a ſaliva in my mouth. On that day I had a deſire to be lifted from my bed, and to ſit up a little, which was done with ſome difficulty; but could not bear my feet on the ground, my knees alſo being in a very debilitated ſtate—but found my pains greatly abated. I ſpit a great deal the next night, which was very thin, and not diſagreeable. On the eighth day my pains ſeemed quite gone; and requeſted again to get up, when to my great ſurprize I found myſelf capable of bearing the weight of my body on my legs. On the ninth day I was capable and abſolutely walked from my bed to my chair, the diſtance of ſix feet, without aſſiſtance.—I beſpoke a pair of crutches, but, thank God, I never uſed them, nor have had occaſion for them; for on the tenth day I walked ſeveral times backwards and forward my room

 without

without crutch or ſtick, or any other aſſiſtance whatever. On the eleventh day I walked from one room to another, and finding it attended with no extra pain, but ſtiffneſs and weakneſs in my ſhins, I abſolutely walked up a pair of ſtairs of fourteen or ſixteen ſteps, and down again. My appetite was now reſtored to an amazing degree, inſomuch that I found I could not continue the uſual quantity of medicine (which in fact ſeemed to have operated more like a charm than a medicine) but I continue taking about three parts in four thereof daily. And I have the pleaſure further to inform you, that I have walked out ſeveral times, and yeſterday in particular I walked more than a mile, and was in hopes to have ſurprized you (which I know would have been an agreeable one) by paying you a viſit at your own houſe; but was informed you was from home.—Be aſſured I ſhall always eſteem it a pleaſure to anſwer any queries reſpecting my caſe, and the efficacious operation of the acid in ſo wonderful a cure.

Believe me to be

Dear Sir,

——— ———

BRISTOL,
Nov. 25, 1796.

To Mr. BAYNTON.

Nov. 29, 1796. The Editor in company with another perſon met Mr. H. at Mr. Baynton's. Mr. H. by word of mouth confirmed the preceding ſtatement; and added a variety of particulars reſpecting his former and preſent ſtate. He ſaid that his daily doſe of colourleſs ſtrong nitrous (nitric) acid was two drachms, diluted by a quart of water. The mixture produced no immediate ſenſation in the ſtomach. He was never griped by it; and he thought it rather aſtringent; for he had no ſtool in three or four days after beginning this courſe, which was unuſual with him; but he would not take any aperient medicine, that nothing might interfere with the acid. On the ſeventh day he perceived a flow of ſaliva; on the

eighth the ſalivation amounted to a quart; and it has continued in a greater or leſs degree ever ſince. There was no ſoreneſs of the mouth, or any of the feelings which had formerly been produced by mercury. In two or three days after this effect on the ſalivary glands, he loſt his night pains. On being lifted out of bed, he was aſtoniſhed to find he could ſtand without ſupport, "whereas" ſaid he, putting his hand on his knee, "theſe limbs could not before "have ſuſtained a ſingle ounce." The nodes, which were of the ſize of a hen's egg on the tibia, and of which there were ſeveral on the back part of the humerus and radius of one arm, began to diminiſh. The Editor, who had this interview three weeks after the firſt exhibition of the acid, found the tibiæ rough, but without excreſcence; all the nodes having diſappeared. Mr. H.'s noſe, which had been conſiderably enlarged, was now of the natural ſize. His hands, which had been "a miſhapen maſs," had no preternatural appearance. Before, he could not bend any of his fingers; now he could bend them all, but the forefinger of the right hand. A great difficulty of deglutition had diſappeared at the commencement of the ſalivation. His general bodily condition had been much amended, and his appetite had become ſo keen, that he could hardly find time enough in the day to eat and to take his diluted acid.

This account fully confirms an important part of Mr. Scott's aſſertions. And the effect of the nitric acid in the inſtance of Mr. H. furniſhes an additional probability that the firſt caſe in this Number was not venereal, when the patient began to take the acid. The reſult of that caſe goes ſome way towards determining the limits of its power, which cannot however be fixed without a number of experiments. The Editor has the pleaſure to add that he has before him a letter from an accurate medical obſerver, in which he ſays that "he has uſed nitric acid with great advantage in ſome caſes which he believed to be hepatic, and in one venereal caſe with apparent advantage."

An ingenious friend had conjectured from Mr. Scott's paper, that nitric acid only renders the ſyſtem

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tem susceptible of the mercurial stimulus. But Mr. H. took no mercury between the middle of August, and the second week in November. In the effect too on the mouth Mr. H. remarked a striking difference.

The Editor flatters himself that to have ascertained the mild action of the nitric acid in these two cases, and its effect in checking night-sweats in the first, will, in all likelihood, prove advantageous to medicine in various respects. The personal examination of Mr. H. has put it out of his power to doubt of the utility of Mr. Scott's practice. He reckons its success among the fruits that were to be expected from the cultivation of the pneumatic physiology. He felt from the first that his particular speculations were precarious, and he some time since gave up his supposition relative to the state of the system in consumption. *(See second Edition of parts* I. *and* II. *of Considerations*). But he was confident that if he could fix the eye and the mind of his medical contemporaries on those agents, upon which the mechanism of life so immediately depends, they would not fail speedily to acquire much of that power, which the knowledge of nature confers.

The discovery of every new *specific* (or substance capable of correcting given morbid actions of the system) affords a new reason for believing in the existence of others. For some scrophulous ulcers we seem to have found a new specific in sorrel; for venereal and hepatic affections in nitric acid, such as we possessed before in mercury. These are diseases, in themselves not many degrees less formidable than cancer and consumption. We have analogies enough to persuade us, that there is no lesion of organization, induced by the powers of the living body modified in one way, which the same powers, differently modified, may not repair; and that, by dint of frequent ventures, some happy hand will draw from the lottery of Nature a remedy for each of those diseases, which at present most baffle the physician and torture the patient.

APPEN-

APPENDIX.

N°. VI.

Extract from a Paper, entitled *Instruction concerning the means of preserving salubrity, and purifying the air, in the military hospitals of the French Republic*, as it appeared in the Journal de Physique, Ventose, an 2e ére franç..

Au nombre des moyens que la chimie a employés avec un succès qui tient du prodige, pour opérer cette dépuration (des lieux infectés), nous citerons le procédé que *Guiton*, représentant du peuple, a mis en usage en 1773, dans la ci-devant cathédrale de Dijon, infectée par des exhumations, au point qu'on fut obligé de l'abandonner.

Ce moyen consiste à répandre dans l'atmosphère, de l'acide muriatique (acide marin) en état de gaz, dégagé par l'intermède de l'acide sulfurique (huile de vitriol). Voici le procédé pour désinfecter une salle de 40 à 50 lits.

Après avoir évacué les malades sur une des salles de rechange, disposez dans le milieu de la salle vuide, dont les fenêtres & les portes seront fermées, un fourneau garni d'une petite chaudière ou capsule de fer à demi remplie de cendre tamisée sur laquelle on posera une capsule de verre, de grès, de fayance même, chargée de neuf onces de muriate de soude (sel marin) légèrement humecté, avec une demionce au plus d'eau commune.

Le feu étant allumé & la capsule échauffée, on versera sur le sel marin quatre onces d'acide sulfurique, ou huile de vitriol du commerce. En un instant l'acide sulfurique agira sur le sel marin dont l'acide se mettra en expansion. L'opérateur qui sera le pharmacien en chef, ou un de ses aides versé dans le manuel des opérations chimiques, se retirera en fermant la porte sur lui & emportant la clef.

Douze heures après on entrera dans la salle. On ouvrira portes & fenêtres pour établir des courans d'air, & évacuer celui qui pourroit être encore chargé d'acide.

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On donnera une plus grande latitude d'utilité à ce procédé en l' appliquant aux salles même remplies de malades, toutes les fois que les Officiers de Santé le jugeront nécessaire. Ainsi, lorsqu'on aura reconnu que l'air d'une salle est surchargé de miasmes animaux, & a besoin de cet excellent purificateur, il suffira de faire le tiers du mélange cidessus & même moins, & de la parcourir plus ou moins lentement et dans tous les points, le réchaud à la main, au moment où le gaz se met en expansion. Lorsque la salle sera jugée suffisamment remplie de gaz acide muriatique, on transportera l'appareil dans les latrines, afin que les dernières portions gazeuses que le mêlange pourra continuer de fournir, servent à neutraliser les gas ammoniacaux putrides qui se développent continuellement dans les privés.

Cette opération *qui n'occasionne aucune sensation désagréable ni incommode*, suffira néanmoins pour sanifier une salle; & on pourra l'employer tous les jours, & même plus souvent d'une manière partielle, dans les salles où un ou plusieurs malades affectés de gangrène ou de quelqu'autre maladie putride, répandroient des miasmes dangereux. Dans un cas d'urgence, s'il se trouve dans la pharmacie de l'acide muriatique concentré (acide marin fumant) on obtiendra le même effet en portant dans les salles la bouteille ouverte; & si cet acide n' est pas assez concentré, on le chauffera pour le réduire en état de gaz. Enfin, on répétera ces différens procédés toutes les fois qu'il sera jugé néceffaire par les officiers de santé, ainsi que cela se pratiquoit pour les inutiles & même dangereuses fumigations aromatiques.

Fumigations with mineral acids must, like the telegraph, have been introduced into the British military system. But Dr. J. C. Smyth has earned a civic wreath by first labouring to introduce them, though here the trials took place near two years later than they were enjoined by public authority in France; and his experiments on the respirability of the copious fumes of marine or nitric acids were not, I understand, made before July or August 1795.—When Dr. Smyth however lays claim to the merit of more exact, early, and comprehensive views, it is more than doubtful whether his pretensions will be admitted by the impartial historian of medical science. The Doctor descends to carping objections, and he strains

ſtrains very hard to eſtabliſh diſtinctions in doctrine and practice between himſelf and the French phyſicians. I have above been at ſome pains to enable the public to judge whether theſe diſtinctions are juſt: and I ſhall here produce what I conſider as no trivial miſtatement of the opinions of the *council of health*. "The French phyſicians" ſays Dr. Smyth, "appear to me to have fallen into a conſiderable "miſtake on this ſubject in taking the quantity of "carbonic acid preſent in an hoſpital *as a* TEST *of* "*the quantity or malignity of contagion*, when, in "reality, they are two things totally diſtinct from "each other." (pp. 204. 205.) In a note he adds, "The method propoſed by the French phyſicians "for aſcertaining the quantity of carbonic acid is "ſimple and ingenious. Take two phials: let one "be filled with common water, the other with lime-"water. At the place where you want to try the "purity of the air, empty the phial of common "water, then filling it half-full with lime-water "and corking it, ſhake the phial for ſome time: "the quantity of ſediment ſhews the proportion of "carbonic acid. But to render the preceding ex-"periment concluſive, the height from the ground "at which the air is taken ſhould be ſtated; *other-*"*wiſe we are liable to great fallacy.*"

Now as the great point ro be aſcertained is the condition of the air which the patients are breathing, it happens that the authors of the *inſtruction* have been much more judicious than if they had aſſigned a certain height. They direct the air to be taken near the bolſters of the beds. *Dans les angles & vers le chevet des lits des malades.* They doubtleſs knew of Mr. Lavoiſier's experiments on the air of crowded rooms, taken at different heights, and could have applied them, had the occaſion been proper. There is however a juſt exception (and it is mentioned by Mr. Lavoiſier as rendering the experiment abortive) to their method. A quantity of carbonic acid air is abſorbed by the common water, as it iſſues out of the phial.

The French council (and here is the miſtatement) by no means ſpeaks of carbonic acid as any TEST of con-

contagion. They properly employ a loose expression. *Il paroit très-vraisemblable, d'après les nouvelles connoissances sur la nature des gaz, que dans les salles suspectées d'insalubrité, les miasmes putrides sont toujours accompagnés d'une* assez grande quantité *d'acide carbonique.* (p. 170.) They seem here to hold in view places, where animal substances have fermented, full as much as those where the sick breathe; and it is true that in both there will be "*a good deal*" of carbonic acid air, particularly in the former, as the meritorious researches of Mr. Lavoisier have so fully proved.

The foreign philosophers will assuredly not deem it worth while to examine the book of their *would-be-critic* with a prying pick-fault eye. But they will smile to find one who is perpetually either ignorant or mistaken concerning familiar chemical facts, presuming upon "those improvements, which *a more* "*accurate chemistry*, and a long attention to the sub-"ject have suggested to him." (On Jail-distemper, p. 181.) The uninstructed may be amused by observing how he hunts oversights, splits hairs, publishes what he acknowledges to be a superfluous exhibition of his own merits,* and anxiously calls to his aid every little art, by which the interest of his vanity may be promoted. The substitution of nitre for common salt was a good, though obvious, thought, and seems to have answered excellently. But what there is of discovery—viz. the having strictly ascertained that acids will destroy contagion, and the process for extricating the fumes—properly belongs to Mr. Morveau. Otherwise, should any one try fumes of *acetic* acid, if he finds the progress of infection stopped, he too, if he should chuse to assume a self-trumpeting tone, may claim to be a discoverer; and he would have to say that his predecessors strangely overlooked *acetic* acid, though of all acids the most agreeable and reviving to the sick.

* *Memorial to Lord North* (p. 227), of which he says, "others (besides his friends) "may consider it as so many blank pages," and in which he tells Lord North "how during the intervals of the "operation of a violent emetic, he continued to dictate instruc-"tions to the surgeon . . . . . being apprehensive lest the "fever" should seize his head. (p. 234.)

APPENDIX.

No. VII.

Extract from a Letter on Femoral Hernia.

Dear Sir,

I HAVE great satisfaction in saying, that Captain Hemsley has, ever since I wrote last, continued gathering strength. I saw him a few days ago, when he assured me, he entertained little doubt of speedily reassuming the command of his vessel.—I should have written to you some time ago, had it not been that I wished to communicate the following case: Being called to a consultation in a case of crural Hernia, which had been strangulated for a week, and had resisted every effort of the Taxis, there remained no other means but the operation. The Gentlemen attending having requested me to perform the operation, I assented, and determined to profit by the very judicious observations, and accurate description of the parts, as given in your Translation of *Mr. Gimbernat's New Method of operating for the Femoral Hernia.* Johnson.——My subject was a Female near sixty years of age, the Hernia was on the right side, and contained a portion of the ileum. After having opened the sac, and made every prudent effort to reduce the contents without success, I dilated the internal edge of the ring in the manner recommended. This enabled me to replace the contents of the tumor. I then treated the wound by suturing and superficial dressings. A large opiate given in alcohol immediately after the operation steadied the stomach, and a few grains of calomel in pills procured a discharge by the bowels. From the moment of the operation no untoward symptom took place. The wound suppurated kindly, and in less than three weeks was perfectly healed.

I have before performed this operation, when I divided the upper part of the ring. My patient recovered perfectly, and has remained well ever since—now three years. Yet I own I prefer Mr. G.'s mode on two accounts. There is less danger of dividing an artery of consequence (which so situated is always difficult to take up)—and the parts necessary to sustain the viscera are less injured. These are weighty considerations.

I am, &c.

E. KENTISH.

Newcastle, Nov. 1, 1796.

APPEN-

APPENDIX.

No. VIII.

BOWOOD, near CALNE, Oct. 1796.

CASE of CONSUMPTION.

JOHN HIGHET aged 22 (whofe father and two Sifters died of a pulmonary confumption) having over-heated himfelf 18 months ago, got a fpitting of blood, which was followed by a fuppuration in the left lobe of the lungs. He coughed very violently, and fpit a vaft quantity of pus. He wafted gradually away, fo that he could fcarce move about, and was obliged to quit his bufinefs, which was that of a journeyman taylor. He was advifed by an old man (who had fince forty years directed the lime-kiln in Bowood park, and who told him that about ten years ago a nobleman was cured by this lime-kiln,) to infpire every day during an hour the fmoke of the kiln. He immediately did it and found almoft inftantaneous relief by it; the fpitting changed in a few days from a purulent matter into a clear tranfparent mucus, his cough and pain diminifhed, the hectic fever abated; and he felt inftead of heat, rather a chillinefs or cold: his flefh returned with his appetite and ftrength, his countenance changed from a fickly appearance to a healthy look—the pain which he felt near the heart fhifted to the ribs, where he finds fince that time a continual uneafinefs, which increafes into a painful fenfation when he lies on his right fide, which I think comes from the lung being attached to the pleura of the left fide. In about three weeks he feemed nearly cured of the confumption.

The manner of infpiring the fmoke, (I affifted more than once at the operation) was to put his head over

over the lime-kiln at the place, where, by poking a hole in the ftones with an iron pointed bar as far as the living coals, a thick yellow fmoke iffued fo as to conceal the whole head from the fight of the bye-ftanders. He inhaled this fmoke with mouth and noftrils open during a whole hour every morning.

A medical gentleman thought this cure to be performed by the inflammable gaz produced by the coals and by the fixed air mixing with the inflammable: but I doubted much of the foundation of this opinion, as inflammable air muft very likely be confumed by the fire of the living coals at the very time of its production.* I think it more probable that the effect was rather owing to the fmoke carrying with it the balfamic tar infinitely divided in its voleume, which is for the greateft part tar itfelf. The healing quality of this fmoke was not owing to any mixture of carbonic acid or fixed air, produced by the calcination of the ftones into lime; for the fame patient found alfo a great relief by inhaling the fmoke of pit coal by a common fire.

It might be reafonably doubted, whether all pit coal would produce the fame falutary effect, for the nature of pit coal from various mines is very different; fome containing a great deal of fulphur, pyrites, alum, and various other ingredients. Thofe that contain fulphur would probably prove very hurtful.

I did what I could to procure fome more patients labouring under pulmonary confumptions, as alfo ulcerated legs, or fome difeafes of that nature, to try whether this fmoke would not cure them as readily as it did cure the above-mentioned patient; but I could procure none. It is however well known, a long while ago that lime kilns have had the reputation of curing various difeafes, principally pulmonary confumptions. I believe it worth while trying, to let the patients inhale the fmoke of pit coal from a common

* Heavy inflammable air would, I apprehend, be plentifully diftilled from the heated, but uninflamed, part of the coals. I am however difpofed to agree with Dr. Ingenhousz as to the curative operation of the tar in vapour. *Editor.*

common fire. But I ſhould not adviſe to inhale this ſmoke in a concentrated ſtate, iſſuing from theſe coals heated in a retort; as in this caſe a very concentrated inflammable air mixed with the ſmoke may do injury. However, it may be tried with prudence.

By placing in the middle of the lime kiln flat veſſels filled with lime water, and others filled with a ſolution of turnſol, I found that in half an hour the lime water was ſcarcely precipitated any more than it was at twenty feet diſtant—that turnſol was not changed at all in colour. But in half an hour I found the oleum tartari per deliquium, rubbed againſt the inſide of a cylindrical glaſs, cryſtallized into aciculary cryſtals, as it cryſtallizes in a brew-houſe or where beer ferments. An equal quantity of theſe coals and lime-ſtone diſtilled in a ſtone retort, gave a vaſt deal of fixed air mixed with very concentrated inflammable air and ſmoke. The inflammable air burned with a brilliant flame in a cylindrical glaſs, in which it was received from the retort. The ſides of this glaſs were all lined with a coat of ſemi-tranſparent tar.

J. INGENHOUSZ.